Village of Newtok, Alaska

Local Hazards Mitigation Plan

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Acronyms

ADOT/PF	Alaska Department of Transportation and Public Facilities
AEIS	Alaska Earthquake Information System
ANCSA	Alaska Native Claims Settlement Act
ASCG	ASCG Incorporated of Alaska
ATV	All-terrain Vehicle
AVCP	Association of Village Council Presidents
AVEC	Alaska Village Electric Cooperative
AWCG	Alaska Wildfire Coordinating Group
BFE	Base Flood Elevation (100 year flood)
BIA	Bureau of Indian Affairs
CDBG	Community Development Block Grant
CDQ	Community Development Quota Program

CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Coastal Management Plan
CRS	Community Rating System
CRSA	Coastal Resource Service Area
DCCED	Department of Commerce, Community and Economic Development
DHS&EM	Alaska Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
FBFM	Flood Boundary and Floodway Map
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FHLBB	Federal Home Loan Bank Board
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
GPS	Global Positioning System
HAZUS	Hazards U.S.
LHMP	Local Hazards Mitigation Plan
LKSD	Lower Kuskokwim School District
MSL	Mean Sea Level
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NTC	Newtok Traditional Council
NWS	National Weather Service
PDMG	Pre-disaster Mitigation Grant
SBA	Small Business Administration
USARC	United States Arctic Research Commission
USCOE	United States Army Corps of Engineers
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
YDFM	Yukon Delta Fish Marketing Cooperative
YDNWR	Yukon Delta National Wildlife Refuge
YKHC	Yukon-Kuskokwim Health Corporation

Chapter 1. Planning Process and Methodology

Introduction

This Local Hazards Mitigation Plan (LHMP) for the Village of Newtok includes information to assist the tribal government and residents with planning to avoid potential future disaster losses. The plan provides information on natural hazards that affect Newtok, descriptions of past disasters, and lists projects that may help the community prevent disaster losses. The plan was developed to assist the tribe in making decisions regarding natural hazards that affect Newtok.

The scope of this plan is natural hazards: flooding, erosion, severe weather, tundra fire and earthquake hazards. However, some of the mitigation projects for natural hazards would also mitigate impacts from other hazards.

Because of the imminent danger, the village, state and federal agencies to relocate Newtok to Mertarvik are undertaking immediate efforts. Therefore, the only mitigation projects of substantive benefit to the community are: (1) assistance in moving structures to the new site; and, (2) short term protection for infrastructure currently in Newtok.

The Newtok Background for Relocation Report, January 2004, Newtok Traditional Council, prepared by ASCG Incorporated of Alaska (ASCG) was used extensively for the Newtok LHMP.

The Village of Newtok, Alaska is being threatened by the high rate of erosion of the Ninglick River bank adjacent to the village. This erosion has been occurring for years and is recognized as a critical threat to the existence of the village. The Ninglick River eroded away approximately 3,320 linear feet of land in front of the village between 1954 and 2003. The average annual erosion rate for this period was 68 feet per year. In 2003 however, 110 linear feet of land between the river and the village washed away.

Approximately 735 linear feet of land separate the river and residential storage areas and steam houses, with 830 linear feet left between the river and the closest four residences at the south end of the village. The Newtok Shoreline Erosion Map in The map folder of this plan shows projections indicating storage areas and steam houses physically impacted by erosion in approximately 12 years (2015) and the closest residences impacted in 2016.

Photo 1. Aerial Photo of Newtok

In the Pictures Folder submitted with this LHMP are photos showing a flooding event on September 22 and 23, 2005. These photos graphically illustrate that structures are already impacted.

The Newtok Tribe has inhabited this coastal region for hundreds of years, and has taken a proactive approach to this serious threat to Newtok's homes and facilities. Since the 1970s, the Newtok Traditional Council (NTC) has continuously monitored the encroaching erosion by measuring with stakes. Since the early 1980s, they worked with Woodward-Clyde Consultants and the U.S. Army Corps of Engineers (USCOE) studying the problem and searching for means of mitigation. The conclusion of these efforts is that the village must relocate, as there is no permanent and cost effective alternative available for remaining at the current site. This conclusion is discussed in greater detail in Chapter 3 of the plan.

Plan Development

Location

The Village of Newtok is a coastal community situated on the west bank of the Newtok River, just north of the Ninglick River and approximately nine miles northwest of Nelson Island. The Ninglick River connects the Bering Sea with Baird Inlet, located upstream from Newtok. The village is located 94 miles northwest of Bethel, in the Yukon-Kuskokwim Delta Region. The north, east, and south boundaries of the community are contiguous with the Yukon Delta National Wildlife Refuge. The geographical coordinates for the community are approximately 60 degrees, 56 minutes North and 164 degrees 38 minutes West (Sec. 24, T010N, 087W, Seward Meridian). The area encompasses 1.0 square mile of land and .01 square mile of water.

Project Staff

The Village of Newtok Traditional Council reviewed and approved the plan. Tribal Administrator Stanley Tom was the project leader for the village.

Ervin Petty and Andrew Jones of the Division of Homeland Security & Emergency Management (DHS&EM) provided technical assistance and reviewed the drafts of this plan.

ASCG Incorporated of Alaska and Bechtol Planning & Development were hired to write the plan.

Plan Research

The plan was developed utilizing existing Newtok plans and studies as well as outside information and research. Outside sources are credited in parentheses after their inclusion and in the bibliography.

Public Involvement

The Newtok Traditional Council held a public meeting on the plan in the Village on July 12, 2006. The meeting was noticed using usual meeting notification methods. The public and the Council provided input at the meeting into the plan. Also on July 12, 2006 the contractor met with Village representatives, took global positioning system (GPS) readings and toured the village.

The Village of Newtok Traditional Council reviewed and approved the plan before the final draft was prepared.

A copy of the draft Plan is available for public perusal at the Tribal Office. The Council will hold another public meeting and approve the plan after pre-approval from the State and FEMA.

Because of the relocation effort the community of Newtok has had many public meetings on the natural hazards the village faces. The community is extremely involved and well educated regarding natural hazards. They live with the eroding shoreline and the eminent danger of flooding every day. The tribal administrator and Council travel monthly to Anchorage to meet with the Newtok Planning Group, which is a multi-agency and organization effort. The Planning Group is comprised of the following organizations: DHS&EM, DNR, USCOE, DOT&PF, ADF&G, Denali Commission, FAA, Alaska Village of Council Presidents, Housing and Urban Development, Bureau of Indian Affairs, Lower Kuskokwim School District, Yukon-Kuskokwim Health Corporation, among other organization. The Village Council of Presidents has been directly involved in the LHMP and the effort to relocate the community.

The Newtok LHMP has been discussed, reviewed and input has been provided into the natural hazard danger at several of the agency meetings. It is a high priority for all parties to be completed.

Plan Implementation

The Newtok Traditional Council will be responsible for adopting the Newtok LHMP and all future updates or changes. The tribe has the authority to promote sound public policy regarding hazards. The Hazards Mitigation Plan will be assimilated into other Newtok plans and documents as they come up for review or are completed according to each plan's review schedule.

Table 1. Newtok Plans

Document	Completed	Next Review
Newtok Background for Relocation Report	2004	Not Applicable
Ceñaliulriit (Yukon-Kuskokwim) CRSA* Coastal Management Plan	2006	Not Determined
Transportation Plan	2001	2007
Transportation Plan Update	2007	2008
Land Use Plan	Future Plan	Not Determined
Landfill Plan	Future Plan	Not Determined
Sanitation Plan/Feasibility Study	Future Plan	Not Determined
Airport Plan	Future Plan	Not Determined

* Coastal Resource Service Area

Continuing Review Process

The Tribal Council of Newtok will evaluate the Newtok LHMP on an annual basis to determine the effectiveness of programs and to reflect changes in land development, status, or other situations that make modifications to the plan necessary. The Tribal Council and the staff will review the mitigation project items to determine their relevance to changing situations in the village, as well as changes in state or federal policy and to ensure that mitigation continues to address current and expected conditions. The tribe will review the hazard analysis information to determine if this information should be updated and/or modified, given any new available data or changes in status.

Continued Plan Development

The plan will continue to be developed as resources become available. Additional hazards not currently covered in the plan, including technological and manmade hazards, will be added if funding becomes available during the next five-year update cycle.

The plan will be updated every five years or as funded or required by the Division of Homeland Security.

The tribe will be responsible for updating and maintaining the plan by adding additional hazards and completing vulnerability assessments for existing hazard chapters.

The following table lists the schedule for completion of these tasks, provided that funds are available to do so.

Table 2. Continued Plan Development

Hazard	Status	Hazard Identification Completion Date	Vulnerability Assessment Completion Date
Floods/Erosion	Completed	2007	2007
Severe Weather	Completed	2007	2007
Tundra fire	Completed	2007	2007
Earthquake	Completed	2007	2007
Economic	Future Addition	2012	2015
Technological	Future Addition	2012	2016
Public Health Crisis	Future Addition	2009	2011

Continued Public Involvement

Agenda item on regular Tribal Council meetings.

Spring break up meetings.

Copies of the plan will be available at the tribal office.

Risk Assessment Methodology

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, and disruption to local and regional economies, environmental damage and disruption, and the amount of public and private funds spent to assist with recovery.

Mitigation efforts begin with a comprehensive risk assessment. A risk assessment measures the potential loss from a disaster event caused by an existing hazard by evaluating the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards and their impact on community assets.

A risk assessment typically consists of three components; hazards identification, vulnerability assessment and risk analysis.

1. *Hazards Identification* – The first step in conducting a risk assessment is to identify and profile hazards and their possible effects on the jurisdiction. This information can be found in Chapter 3: Hazards.

2. *Vulnerability Assessment* – Step two is to identify the jurisdiction's vulnerability—the people and property that are likely to be affected. It includes everyone who enters the jurisdiction including employees, commuters, shoppers, tourists, and others.

Populations with special needs such as children, the elderly, and the disabled should be considered; as should facilities such as the health clinic because of their additional vulnerability to hazards.

Inventorying the jurisdiction's assets to determine the number of buildings, their value, and population in hazard areas can also help determine vulnerability. A jurisdiction with many high-value buildings in a high-hazard zone will be extremely vulnerable to financial devastation brought on by a disaster event.

Identifying hazard-prone critical facilities is vital because they are necessary during response and recovery phases. Critical facilities include:

- Essential facilities, which are necessary for the health and welfare of an area and are essential during response to a disaster;
- Transportation systems such as boardwalks, airways and waterways;
- Utilities;
- High potential loss facilities such as the levee and bulk fuel storage facilities; and
- Hazardous materials sites.

Other items to identify include economic elements, areas that require special considerations, historic, cultural and natural resource areas and other jurisdiction-determined important facilities.

3. *Risk Analysis* – The next step is to calculate the potential losses to determine which hazard will have the greatest impact on the jurisdiction. Hazards should be considered in terms of their frequency of occurrence and potential impact on the jurisdiction. For instance, a possible hazard may pose a devastating impact on a community but have an extremely low likelihood of occurrence; such a hazard must take lower priority than a hazard with only moderate impact but a very high likelihood of occurrence.

Additionally, the risk analysis must utilize a multi-hazard approach to mitigation. One such approach might be through a composite loss map showing areas that are vulnerable to multiple hazards. For example, there might be several schools exposed to one hazard but one school may be exposed to four different hazards. A multi-hazard approach will identify such high-risk areas and indicate where mitigation efforts should be concentrated.

Currently there are insufficient funds and data with which to conduct an accurate risk analysis for all the hazards affecting Newtok. However, risk analysis information will be added as it is completed.

Vulnerability Assessment Methodology

The purpose of a vulnerability assessment is to identify the assets of a community that are susceptible to damage should a hazard incident occur.

Critical facilities are described in the Community Profiles Section of this hazard plan. A vulnerability matrix table of critical facilities as affected by each hazard is provided in Chapter 3 of this document.

Facilities were designated as critical if they are: (1) vulnerable due to the type of occupant (children or elderly for example); (2) critical to the community's ability to function (roads, power generation facilities, water treatment facilities, etc.); (3) have a historic value to the community (cemetery); or (4) critical to the community in the event of a hazard occurring (emergency shelter, etc.).

Based on a pilot program the Federal Emergency Management Agency (FEMA) and the Alaska DHS&EM have initiated to inventory critical facilities in Alaska, it should be taken into consideration that Alaska critical facilities vary fundamentally from other states. A local post office in a rural community in Alaska may also be the location of the police station, emergency operations center, hospital, and only store within 100 miles.

This hazard plan includes an inventory of critical facilities, if applicable, from the Newtok Tribe records and land use map.

Federal Requirement for Risk Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 Code of Federal Regulations (CFR) Part 201.6 (c) (2) include a requirement for a risk assessment. This risk assessment requirement is intended to provide information that will help the community identify and prioritize mitigation activities that will prevent or reduce losses from the identified hazards. The federal criteria for risk assessments and information on how the Newtok LHMP meets those criteria are outlined below.

Table 3. Federal Requirements

Section 322 Requirement	How is this addressed?
Identifying Hazards	Newtok community members identified natural hazards at community meeting, which were used in developing the Plan.
Profiling Hazard Events	The hazard-specific sections of the Newtok LHMP provide documentation for all of the large-scale natural hazards

	that may affect the Tribe. Where information was available, the Plan lists relevant historical hazard events.
Assessing Vulnerability: Identifying Assets and Estimating Potential Losses	Vulnerability assessments for floods, erosion, severe weather, tundra fire and earthquakes have been completed and are contained within the hazard chapter. Additional vulnerability assessments will be added as they are funded and completed.
Assessing Vulnerability: Analyzing Development Trends	The Community Profile Section and Chapter 3 include a description of development in Newtok and the land use maps list all the structures and utilities in the community.

Chapter 2: Community Profile

Community Overview

Location

Newtok is on the Ninglick River north of Nelson Island in the Yukon-Kuskokwim Delta Region. It is 94 miles northwest of Bethel. The community lies at approximately 60.942780° North Latitude and -164.629440° (West) Longitude. (Sec. 24, T010N, R087W, Seward Meridian.) Newtok is located in the Bethel Recording District. The area encompasses 1.0 square mile of land and 0.1 square mile of water. Newtok is located in a transitional climate.

Climate

Newtok is located within an area classified as the Transitional Climatic Zone of Alaska. This zone is typified by pronounced temperature variations throughout the day and year, and less cloudiness, lower precipitation and humidity than are found in a Maritime climate. Average precipitation is 17 inches, with annual snowfall of 22 inches. Summer temperatures range from 42 to 59 degrees Fahrenheit; winter temperatures range from 2 to 19 degrees Fahrenheit.

History and Culture

Newtok is a traditional Yup'ik Eskimo village, with an active subsistence lifestyle. The people of Newtok share a strong cultural heritage with the Nelson Island communities; their ancestors have lived on the Bering Sea coast for at least 2,000 years. The people from the five villages in the area are known as Qaluyaarmiut, or "dip net people". Relative isolation from outside influences has enabled the area to retain its traditions and customs; more so than more accessible parts of Alaska. The area had only brief and intermittent contact with Russians and Americans until the 1920s.

Around 1949, the village was relocated from Old Kealavik three miles away, to its present location along the Newtok River and a school was built in 1958. The existing village site was the farthest point up river the Bureau of Indian Affairs (BIA) barge could access to off-load the school building materials.

The residents of Newtok continued a migratory pattern through the 1960s, spending summers in fish camps on Nelson Island and wintering at the current village site. After the fishing season, Newtok's men often traveled to Bristol Bay to work in the canneries. Thus Newtok remained primarily a winter residence for its people. By the 1970s, however, snow machines and modern housing projects had replaced dog teams and sod houses in Newtok; residents began to assimilate elements of American culture and to remain more stationary.

Population

The 2000 U.S. Census recorded a population of 321 (54% male and 46% female). Alaska Natives represented 96.9% of the population. The majority of the population is Yupik Eskimo. There were 63 households with an average household size of 5.1.

According to the Alaska State Department of Commerce, Community and Economic Development (DCCED), the population increased from 114 in 1970 to 321 in 2000. ASCG developed a population projection using this increase in growth from 1970 to 2000. The average annual growth rate for this period was 3.51%. If this rate of increase continues, Newtok can expect a population of 640 by 2020.

Government/Organizations

Newtok was incorporated as a second-class village within an unorganized borough in 1976. In 1997, the city government was dissolved. The BIA-recognized Newtok Traditional Council conducts local government affairs. The Newtok Native Corporation also serves the village. Contact information follows.

Table 4. Newtok Community Information

Community Information	Contact Information and Type
Current Population:	323 (DCCED 2006 Cert. Pop.)
Incorporation Type:	Unincorporated
Tribe Contact Information:	Newtok Traditional Council P.O. Box 5545, Newtok, Alaska 99559 Stanley Tom, Tribal Administrator Phone: 907-237-2314 Fax: 907-237-2428 Email: stanley_tom2003@yahoo.com
Borough Location:	Unorganized borough
Village Corporation:	Newtok Corporation P.O. Box 5528 Newtok, AK 99559 Phone 907-237-2512 Fax 907-237-2227

Community Information	Contact Information and Type
Regional Native Corporation	Calista Corporation 301 Calista Court, Suite A Anchorage, AK 99518-3028 Phone 907-279-5516 Fax 907-272-5060 E-mail calista@calistacorp.com Web http://www.calistacorp.com
CDQ Group	Coastal Villages Region Fund 711 H Street, Suite 200 Anchorage, AK 99501-3461 Phone 907-278-5151 Fax 907-278-5150 E-mail morgen_c@coastalvillages.org Web http://www.coastalvillages.org/
Economic Development. Community Development Quota (CDQ) Program	Yukon Delta Fisheries Development Association 2200 6th Ave., Suite 707, Seattle, WA 98121 Phone: 206-443-1565 Fax: 206-443-1912 (for Wade Hampton/Lower Yukon Communities: Alakanuk, Newtok, Kotlik, Nunam Iqua, Grayling, Mountain Village)
Regional Native Health Corporation	Yukon-Kuskokwim Health Corporation P.O. Box 528 Bethel, Alaska 99559 Phone: 907-543-6020 Fax: 907-543-6006 Email: gene_peltola@ykhc.org

Economy/Transportation

The school, health clinic, Traditional Council, Native Corporation, and commercial fishing provide most employment. Subsistence activities and trapping supplement income. Twenty-two residents hold commercial fishing permits.

According to the 2000 census, the median household income was $32,188 with 31% of residents living below the poverty line. There were 101 people employed with 33 people looking for work, or 24.6% unemployed. This unemployment rate, when combined with able-bodied adult workers not in the labor force, equals a total unemployment rate of 52.1%.

Public Facilities

ASCG developed a land use map in 2003 using a 2002 aerial photo of Newtok. See the map in the map folder for referencing the location of the following facilities:

Health Clinic

The Newtok Health Clinic provides local health care. The Yukon-Kuskokwim Health Corporation (YKHC) operates the clinic, which was built in 2003.

School

A new modular school was constructed in 2001. The school serves approximately 100 students, and is staffed by six certified teachers. The school has its own sewage lagoon.

Electricity

The Ungusraq Power Company provides electricity. Fuel oil is barged to Newtok during the summer months and stored at fuel tank farms. The Newtok Native Corporation tank farm has a fuel storage capacity of 94,000 gallons, and the Lower Kuskokwim School District (LKSD) has a fuel storage capacity of 121,255 gallons. Tom's Store has a fuel storage capacity of 24,000 gallons for heating fuel and gasoline.

Water

Drinking water is pumped from a nearby lake into a water treatment plant and transferred to the village water tank. Newtok residents haul water from watering points located in the village. Residents supplement their water supply by collecting rainwater in the summer and by melting ice in the winter.

Washeteria

The washers and dryers at the washeteria were closed down in 2000 because of obsolete power lines to the washeteria. Additionally, the washeteria power was turned off because the village power generators are inadequate to accommodate all village electrical needs. Laundry is now done by hand at home using hauled water and clotheslines. Private saunas are used for bathing.

Wastewater

Wastewater from Newtok's homes is collected in honey buckets and dumped along the Newtok River bank. There is no plumbing.

Landfill

The previous village landfill, located on the south end of the village, washed into the Ninglick River through erosion, in 1996. A temporary dumpsite was then established on the other side of the Newtok River across from the village. This has created problems because trash gets dropped off and piles up on the riverbank before it can be transported across the river. Transport across the river is only possible at high tide.

Airport

A State-owned 2,180-foot gravel airstrip provides air access year-round; however, major improvements have been delayed due to the threat of erosion to the village. A seaplane facility is also available, but not widely used.

Transportation

Newtok is accessible by air and water; there are no roads connecting the community with any other communities in the area. Boats, skiffs, and all-terrain vehicles (ATVs) are used in the summer and snow machines are used in the winter for local transportation and subsistence activities.

Barges deliver cargo twice per month during the summer. This is becoming more difficult as the Newtok River entrance to the boat landing becomes shallower.

Photo 2. Boardwalk system in Newtok

There are no roads of any kind in the village. There are approximately 1½ miles of boardwalks within the community that provide the means for foot and ATV transportation. The 800-foot boardwalk connecting the airport to the system of boardwalks in the village is eight feet wide, and in good condition. All other village boardwalks vary between four and eight feet in width and are in poor condition. These boardwalks were built of wood, with most construction occurring in 1976 and 1981. The system is approaching the end of its useful service life.

Right-of-Way

Despite its lack of road development, Newtok has five segments of dedicated right-of-way, including a 110-foot-wide tract containing the boardwalk to the airport. Other corridors, all of which are 40 feet wide, include undeveloped access for a housing area near the school site (in the southeast corner of town), and for a subdivision near the armory at the north edge of town.

Very little subdivision of the Village Corporation property has occurred and consequently, Newtok's boardwalks are wholly contained on land owned by the Newtok Corporation. The Newtok Native Corporation has an Alaska Native Claims Settlement Act (ANCSA) 12(a) entitlement to 92,160 acres but has not acted related to 14(c)(3) status.

Wildlife

Fish and wildlife are abundant in the vicinity of Newtok. The area is a prime habitat of mink, land otter, and beaver. There are occasional brown bear, moose, and caribou. Salmon found in local waters include Coho, Pink, Chum, Sockeye and Chinook. In addition, area waters host black fish, needlefish, white fish, smelt, pike, lush fish, and seal. Birds include swans, cranes, swallows, sandpipers, ravens, crows, seagulls, and a variety of geese.

Soils and Topography

Newtok is a coastal community situated on the west bank of the Newtok River, a slow-moving river draining the flat Yukon-Kuskokwim Delta. Approximately 735 feet to the south is the encroaching Ninglick River, eroding towards the village at an average rate

of 64 feet per year. The surrounding land is flat, low-lying, marshy tundra dotted with thousands of thaw-lakes and sloughs. Vegetation in this low area is primarily the mosses, lichens, hair grass, sedges, and berries typical of tundra.

The bedrock in the area is comprised of non-marine sandstone and siltstone overlaid by volcanic flows and capped with wind-deposited silt. A typical soil profile has deep frozen silt layered with peat at the surface. Permafrost continuously underlies a two-foot active layer (sometimes thicker when a greater layer of peat is present).

The shallow active layer combines with the continuous presence of permafrost and nearly flat surface slopes to yield extremely poor drainage conditions around Newtok. The permafrost is ice rich and, in thaw periods, the active layer is almost completely saturated and has virtually no bearing capacity.

Flooding and erosion raise additional concerns for Newtok. The shoreline is highly vulnerable to flooding, especially during spring ice jams in the river or in severe westerly windstorms on the Bering Sea. Thermal degradation of the riverbanks is causing shoreline sloughing.

Community Assets

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and the environmental integrity of Newtok.

Community Map

The latest community land use map was done by ASCG in 2003.

Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- Newtok Airport

Essential Facilities: Those facilities and infrastructure that supplement response efforts.

- Designated shelters
- Tribal Council building
- Bulk fuel storage tank farm

Critical Infrastructure: Infrastructure that provides services to Newtok.

- Telephone lines
- Power lines
- Transportation networks

- Wastewater collection

Vulnerable Populations: Locations serving population that have special needs or require special consideration.

- School

Cultural and Historical Assets: Those facilities that augment or help define community character, and, if lost, would represent a significant loss for the community.

Community Resources

This section outlines the resources available to Newtok for mitigation and mitigation related funding and training.

Federal Resources

The federal government requires local governments to have a hazard mitigation plan in place to be eligible for funding opportunities through FEMA, such as through the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program. The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described below:

- **How-to Guides.** FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Newtok Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting Disaster Mitigation Act (DMA) 2000 requirements (http://www.fema.gov/fima/planhowto.shtm).

- **Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments.** FEMA DAP-12, September 1990. This handbook explains the basic

concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

- **Mitigation Resources for Success CD.** FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

- **A Guide to Federal Aid in Disasters.** FEMA 262, April 1995. When disasters exceed the capabilities of state and local governments, the President's disaster assistance program (administered by FEMA) is the primary source of federal assistance. This handbook discusses the procedures and processes for obtaining this assistance, and provides a brief overview of each program.

- **The Emergency Management Guide for Business and Industry.** FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Newtok businesses.

Other federal resources include:

- **Department of Agriculture.** Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.

- **Department of Energy, Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program.** This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.

- **Department of Housing and Urban Development, Office of Homes and Communities, Section 108 Loan Guarantee Programs.** This program provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.

- **Department of Housing and Urban Development, Community Development Block Grants.** Administered by the Alaska DCCED, Division of Community Advocacy. Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.

- **Department of Labor, Employment and Training Administration, Disaster Unemployment Assistance.** Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.

- **Federal Financial Institutions.** Member banks of the Federal Deposit Insurance Corporation (FDIC) or Federal Home Loan Bank Board (FHLBB) may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.

- **Internal Revenue Service, Tax Relief.** Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.

- **United States Small Business Administration (SBA).** May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to the Alaska DHS&EM.

Other resources: The following are websites that provide focused access to valuable planning resources for communities interested in sustainable development activities.

- **Federal Emergency Management Agency,** http://www.fema.gov – includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.

- **American Planning Association,** http://www.planning.org – is a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.

- **Institute for Business and Home Safety,** http://ibhs.org – an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways citizens can protect their property from damage.

State Resources

Alaska DHS&EM is responsible for coordinating all aspects of emergency management for the State of Alaska. Public education is one of its identified main categories for mitigation efforts.

Improving hazard mitigation technical assistance for local governments is another high priority item for the State of Alaska. Providing hazard mitigation training, current hazard information, and the facilitation of communication with other agencies would encourage local hazard mitigation efforts. DHS&EM provides resources for mitigation planning on their website at http://www.ak-prepared.com.

DCCED, Division of Community Advocacy: Provides training and technical assistance on all aspects of the National Flood Insurance Program (NFIP) and flood mitigation.

Other state resources include:

- **Division of Senior Services:** Provides special outreach services for seniors, including food, shelter, and clothing.

- **Division of Insurance:** Provides assistance in obtaining copies of policies and provides information regarding filing claims.

- **Department of Military and Veteran's Affairs:** Provides damage appraisals and settlements for Veterans Administration (VA)-insured homes, and assists with filing for survivor benefits.

Other Funding Sources and Resources

- **Real Estate Business.** State law for properties within flood plains requires real estate disclosure.

- **American Red Cross.** Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.

- **Crisis Counseling Program.** Provides grants to State and Borough mental health departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster.

Local Resources

As graphically illustrated by the following three tables, Newtok does not have the usual planning and land management tools found in most other communities in Alaska. The village is unincorporated and is not located in an organized borough. The Tribal Government manages the area without the assistance of Alaska State Title 29 Municipal authority. There is a Tribal Administrator and Tribal Court Clerk employed by the Tribal Council .

Table 5. Legal and Technical Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Y/N)	Comments (Year of most recent update; problems administering it, etc)
Building code		
Zoning ordinance		
Subdivision ordinance or regulations		
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)		
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	Unincorporated Village	
Site plan review requirements		
Comprehensive plan		
A capital improvements plan		
An economic development plan		
An emergency response plan		
A post-disaster recovery plan		
A post-disaster recovery ordinance		

Table 6. Administrative and Technical Capability

Staff/Personnel Resources	Y/N	Department/Agency and Position
City Manager		
City Clerk		
Public Works Director		
Librarian		
Volunteer Fire Chief and Volunteer firefighters		
Planner(s) or engineer(s) with knowledge of land development and land management practices		
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure		
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards		
Floodplain manager		
Surveyors		
Staff with education or expertise to assess the community's vulnerability to hazards		
Personnel skilled in GIS and/or HAZUS		
Scientists familiar with the hazards of the community		
Emergency manager		
Grant writers		
Environmental Advisory Council		

Table 7. Fiscal Capability

Financial Resources	Accessible or Eligible to Use (Yes or No)
Community Development Block Grants (CDBG)	
Capital improvements project funding	
Authority to levy taxes for specific purposes	
Fees for sewer	
Impact fees for homebuyers or developers for new developments/homes	
Incur debt through general obligation bonds	
Incur debt through special tax and revenue bonds	
Incur debt through private activity bonds	
Withhold spending in hazard-prone areas	

Chapter 3: Hazards

Hazard Matrices – Village of Newtok

Table 8. Hazard Matrix

Hazard Matrix – Village of Newtok Bethel Census Area					
Flood	**Tundra fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
Y	Y	Y	N	N	N
Severe Weather	**Landslides**	**Erosion**	**Drought**	**Technological**	**Economic**
Y	N	Y	N	Y	Y

Hazard Identification:	
Y: N: U:	Hazard is present in jurisdiction but probability unknown Hazard is not present Unknown if the hazard occurs in the jurisdiction
High Risk Moderate Risk Low Risk	Hazard is present with a low probability of occurrence; event has a 1 in 10 year's chance of occurring. Hazard is present with a moderate probability of occurrence; event has a 1 in 3 year's chance of occurring. Hazard is present with a high probability of occurrence, event has a 1 in 1 year chance of occurring.

Source: Alaska State All-Hazards Plan, 2007

Table 9. Previous Occurrences

Previous Occurrences - Village of Newtok Bethel Census Area					
Flood	**Tundra fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
13 - L	None	None	None	None	None
Severe Weather	**Ground Failure**	**Erosion**	**Drought**	**Technological**	**Economic**
5 – L	None	2 - L	None	3 - L	1 - L

Extent
Z - Zero - Used for historical information. An event occurred but may not have caused damage or loss.
L - Limited – Minimal through maximum impact to part of community. *Falls short of the definition for total extent*.
T - Total – Impact encompasses the entire community.
Number:
Number of occurrences

Source: Alaska State All-Hazards Plan, 2007

Hazard Vulnerability Assessment

Identification of Assets

Because Newtok is a small community of 315 residents, every structure is essential to the sustainability and survivability of Newtok residents. The Hazard Vulnerability Matrix below includes a list of facilities, utilities and businesses and their vulnerability to natural hazards.

- Essential facilities, which are necessary for the health and welfare of an area and are essential during the response and recovery phase of a disaster such as: village facilities, health clinic, and the school.

- Transportation systems such as: the airport and boardwalks.

- Lifeline utility systems such as: potable water and waste water treatment, fuel farms, electrical generation facilities, and power grid and communications systems.

- Businesses that provides services or commodities.

Hazard Mitigation Matrix

The following table is from Map 1 Newtok Land Use Map, 2003.

Table 10. Newtok Hazard Vulnerability Matrix

Facility	Flood/Erosion	Tundra Fire	Severe Weather	Earthquake
1. Newtok Airport	X	X	X	X
2. Barge Landing	X	X	X	X
3. Airport Garage	X	X	X	X
4. Teachers' Quarters	X	X	X	X
5. School Generators	X	X	X	X
6. School Tank Farm	X	X	X	X
7. Head Start	X	X	X	X
8. Sewage Lagoon	X	X	X	X
9. School Warehouse	X	X	X	X
10. Elementary/High School (LKSD)	X	X	X	X
11. Additional Teachers' Quarters	X	X	X	X
12. Boat Landing #2	X	X	X	X
13. Traditional Council Office	X	X	X	X
14. Health Clinic	X	X	X	X
15. Generator (Ungusraq Power Company)	X	X	X	X
16. Community Water Tank	X	X	X	X

Facility	Flood/Erosion	Wildland Fire	Severe Weather	Earthquake
17. Washeteria	X	X	X	X
18. Phone Company (United Utilities)	X	X	X	X
19. Post Office	X	X	X	X
20. Rental Housing (Traditional Council)	X	X	X	X
21. Old BIA School	X	X	X	X
22. Playground Deck	X	X	X	X
23. Generator (Old BIA School)	X	X	X	X
24. Ungusraq Power Company Office	X	X	X	X
25. Old BIA Harbor	X	X	X	X
26. Old BIA School Tank Farm	X	X	X	X
27. Church Rectory	X	X	X	X
28. Community Hall (Public Meeting, Bingo, Recreation)	X	X	X	X
29. Catholic Church	X	X	X	X
30. Tom's Store	X	X	X	X
31. Tank Farm (Tom's Store)	X	X	X	X
32. Newtok Corporation Stores & Offices	X	X	X	X
33. Warehouse (Newtok Corporation)	X	X	X	X
34. Rental Housing (Newtok Corporation)	X	X	X	X
35. Ice Skating Rink	X	X	X	X
36. Armory	X	X	X	X
37. Tank Farm (Newtok Corporation)	X	X	X	X
38. Boat Landing #1	X	X	X	X
39. Tank Farm (Ungusraq Power Company)	X	X	X	X
40. Graveyard	X	X	X	X
41. New Dump Site	X	X	X	X
42. Old Dump Site	X	X	X	X
43. Dump Unloading Site	X	X	X	X

Newtok's Vulnerability to Identified Hazards:

The natural hazards in Newtok are area wide. The principal hazards of flood, erosion, tundra fire, severe weather, and earthquake could potentially impact any part of Newtok.

Please see the pictures and maps in the Appendix, which demonstrates that the entire Village is in eminent threat of flooding and erosion.

A severe weather event would create an area-wide impact and could damage structures and potentially isolate Newtok from the rest of the state.

Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Newtok to determine structural integrity following earthquake damage. Priority would have to be given critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and finally public utilities.

The vulnerability to tundra fire is also area wide, no one area of the community is in more or less vulnerable.

The new site, Mertavik, located on Nelson Island will not be vulnerable to flooding or erosion, but will be vulnerable to severe weather, earthquake and tundra fire. Please see the following section for detailed information on the new site and the Table 15 Mitigation Strategy Project Plan, page 63.

Section 1. Floods and Erosion

Hazard Description, Characterization and Identification

Types of Flooding in Newtok

The following hazard description and characterization were, in part, taken from the *Ceñaliulriit CRSA Coastal Management Plan Amendment, 2006* and *Climate change impacts, vulnerabilities, and adaptation in Northwest Alaska (No. 06-11).* Please see the bibliography for complete citations.

The effects of climate change are expected to add to natural hazards including flooding in coastal areas. As sea level rises and the offshore ice pack retreats, more flooding can be expected.

Flooding is also caused by ice jams, snowmelt, and rainfall. The highest flood level recorded in Alaska is 46 feet. In areas of low elevation, such as deltas and flat tundra, a 6-inch rise in the water level can flood a vast area.

Factors that affect the level of coastal flooding include wind conditions, exposure of the site and ice conditions. Due to climate change, some coastal areas of Alaska are freezing later in the season; with the later formation of protective shore ice, shorelines will become increasingly vulnerable to fall storms and associated storm surges.

The entire Village of Newtok is subject to continuous permafrost, although in some areas the top layer of the land may thaw during summer. All soils are subject to thermal degradation, and ice-rich fine-grained soil is the most problematic. Melting permafrost can result in lakes or depressions.

Over 80 percent of Alaska is covered by permafrost, and permafrost is recognized as a natural hazard in the scientific literature. A number of institutions have developed extensive research on permafrost including the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory and the Permafrost Laboratory at the University of Alaska Geophysical Institute.

Ice hazards present in the Arctic include strudel scour, ice gouging, shear zone and pressure ridging, and ice override. Ice begins to form during the fall close to shore, moving further out to sea. This ice is known as "shorefast ice". Offshore, multi-year ice becomes grounded, generally at the 66-foot contour in the Chukchi or the 60-foot isobath in the Beaufort Sea (just past the barrier islands). Areas seaward of the 60-foot isobath are covered with pack ice that is continually moving. The ice usually freezes to the bottom when depths are less than 6.5 feet.

The point at which shore ice meets multi-year ice is called the shear zone or "stamukhi zone". The shear zone is unstable during the ice season due to offshore ice movement against the shorefast ice. This simple description of shear zone ice forces is supplemented by traditional knowledge; Arctic residents report that ice is not predictable and ice hazards can reach the shoreline during any time of the year. This zone absorbs much of the energy from the pack ice transferring to the shorefast ice.

Ice ridging can result from forces at the shear zone when large ice masses collide. This ridging leads to ridges and piles of ice. Little ridging occurs inside the barrier islands or out to the 33-foot contour.

When offshore ice bodies ground themselves, a phenomenon known as ice gouging occurs where the ice scrapes deep trenches on the shore bottom. In the Eastern Chukchi Sea, the deepest gouges, up to 15 feet, occur between the 115- and 163-foot isobaths. A maximum depth where ice gouging occurs is the 190-foot isobath in the Chukchi Sea and the 328-foot isobath in the Beaufort Sea. Ice gouging has obvious implications for submarine pipelines.

Ice Override: Movement of ice to a point more than 33 feet from the high-water mark is known as ice override (movements less than that are called ice pile up). Ice override events are often slowed by ice pile-ups. In the Canadian Arctic, ice pile-ups have reached the height of 98 feet.

Arctic residents have reported ice override events that occurred without warning. Areas more susceptible than others to ice override include areas where the nearshore slope is steep and where there are no offshore bars or shoals to slow the movement of ice. Ice override has implications for offshore drilling platforms, ice and gravel islands and shoreside facilities. Most of the ice override events observed in the Beaufort Sea were on the barrier islands including Cross, Jeannette and Narwhal Islands.

Gravel islands in the shorefast ice zone can accumulate piles of ice. Early in the winter the forces related to the ice pile up are not great, but later in the winter, ice rubble can transfer more significant loads to the island.

Melting Sea Ice: Rising temperatures associated with global warming have affected the thickness, extent and duration of sea ice. Sea ice plays an important role to protect coastlines from erosion. As a result of later freezing of sea ice, communities are more vulnerable to waves, storm surges, and erosion.

Both temporary and long-term impacts of the current climate shift, which is expected to continue and even accelerate, are already in evidence in many parts of the globe, but particularly in northern latitudes.

Rising global temperatures are expected to trigger impacts to marine and other ecosystems, including many that will affect the resources and uses in the coastal zone of Alaska. Impacts that can be expected to affect Newtok include a rise in sea level, changing wind and deep-ocean circulation patterns, ocean stratification and resource productivity, shifts in species distributions, outbreaks of disease and harmful algal blooms.

Alaska's climate has warmed about 4°F since the 1950s, 7°F in winter, with much of this warming occurring in a sudden regime shift around 1977. The state has grown wetter, with a 30 percent increase in average precipitation between 1968 and 1990. The growing season has lengthened by about 14 days.

Drastic reductions in sea ice and permafrost have occurred along with the warming. Models predict continued warming, including an increase in temperature by 1.5 to 5°F by 2030 and 5 to 18° by 2100. An increase of precipitation by 20 to 25 percent is expected for the northwestern region of the state, but soils are actually expected to become drier because of the warmer temperatures.

Melting permafrost: A task force commissioned by the U.S. Arctic Research Commission (USARC) in 2002 found that permafrost plays three key roles in the context of climate changes: as a record keeper (temperature archive); as a translator of climatic change (subsidence and related impacts); and as a facilitator of climatic change (impact on the global carbon cycle). The potential for melting of ice-rich permafrost constitutes a significant environmental hazard in high-latitude regions.

Permafrost records temperature changes and other information about environmental changes; it has a memory of past temperatures. Temperature trends spanning a century or more can be recorded in thick permafrost. Analysis of data gathered from boreholes made by the U.S. Geological Survey in northern Alaska show that the temperature of permafrost on the North Slope has generally risen in the past century.

Thawing of ice-rich permafrost may result in settlement of the ground surface, which often has severe consequences for human infrastructure and natural ecosystems. Melting of glaciers in Alaska and elsewhere will increase the rates of coastal erosion in areas of ice-rich permafrost, already among the highest in the world. Sediment input to the Arctic shelf derived from coastal erosion may exceed that from river discharge. Thawing effects to the active layer of permafrost may alter the activities and functions of the permafrost. Soil moisture content has an important effect on its thermal qualities, soil heat flow, and the vegetation is supports.

Permafrost can facilitate further climate change through the release of greenhouse gases. Considerable amounts of carbon are trapped in the upper layers of permafrost; an increase in the thickness of the thawed layer of permafrost could release large quantities of CO_2 and CH_4 to the atmosphere. This could amplify regional and global warming. A further problem in some areas in the Alaskan arctic, is the presence of a significant number of sites where contaminants were buried in previous decades. Contaminants are mobile in the active layer of permafrost and some can be mobile within frozen ground. When permafrost thaws, the ground becomes permeable, allowing contaminants to spread laterally and reach other layers.

The thawing of permafrost will cause changes in hydrology. Where it has a high ice content, thawing can result in severe, uneven subsidence of the surface, called thermokarst, which has been observed to exceed 16 feet. Flooding or draining of an area may result from permafrost melt, affecting the uses of the surface.

Diminished sea ice: Sea ice is a prominent feature of the coasts in the Arctic and adjoining marine ecosystems, and it strongly influences coastal climate, ecosystems, and human activities. Declines of as much as 3 percent per decade since the 1970s have been reported. The area of multi-year ice has declined by 14 percent since 1978.

Arctic sea ice has also thinned over the past few decades. Local observations of thinning by 3.3 feet to 6.5 feet have been reported for several years, and recent submarine ice data has documented evidence of large-scale thinning over the entire Arctic basin. Sea ice retreat allows larger storm surges to develop in the increased open water areas, increasing erosion, sedimentation, and risk of inundation in coastal areas. Coastline where permafrost has thawed is made more vulnerable, and the combination of factors can cause intensified erosion.

Loss of sea ice threatens large-scale change in marine ecosystems, threats to populations of marine mammals that depend on the ice and subsistence livelihoods that depend on them.

One benefit that may be expected from the loss of sea ice include opening of transportation routes where they were previously non-navigable due to ice. However, with an increase in vessel traffic the threat of oil spills increases, and with it the potential for long-term damage from hydrocarbons persisting in coastal ecosystems.

Shoreline erosion: Storms systems along coasts produce high winds that in turn generate large waves and currents. Storm surges can temporarily raise water levels by as much as 23 feet, increasing the vulnerability of shorelines and floodplains to changes to tidal ranges in rivers and bays, and changes in sediment and nutrient transport which drive beach processes.

Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat and presents a challenge for navigational purposes. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion.

Floodwaters pose a health hazard by picking up contaminants and disease as they travel. Outhouses, sewers, septic tanks, and dog yards are all potential sources of disease transported by floodwaters. Lack of a water source is a significant concern for flood victims, especially if the flood has been extensive enough to contaminate the public water supply. In such a case, outside bottled water is at times the only source of clean water.

Erosion is a process that involves the wearing away, transportation, and movement of land. Erosion rates can vary significantly as erosion can occur quite quickly as a result of a flashflood, coastal storm or other event. It can also occur slowly as a result of long-term environmental changes. Erosion is a natural process but its effects can be exacerbated by human activity.

Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat, and loss of land and property.

Table 11. Land Use Types in Newtok

Land Use Type	Number of Uses
Residential	67
Commercial	10
Schools	One, K-12, 100 Students and Teacher Housing
Public Facilities	8

See Table 10 earlier in this chapter, which lists facilities and utilities in areas susceptible to flooding and erosion and a list of structures located in areas of flooding and erosion.

During a site visit on July 17, 2006 the tribal staff related the following vulnerabilities or concerns related to flooding and erosion.

- Winds affect erosion; winds from the south are the most dangerous.
- Each year the village floods three to six feet higher than the previous year.
- Erosion gets worse every year; it is a compounded situation by flooding, wind and erosion.
- The worst erosion occurs in the spring and fall.
- The airport state boardwalk is the only boardwalk that is not in great disrepair.
- The landfill has flooded and needs repaired.

Previous Occurrences

Spring Floods, FEMA declared (DR-0832) on June 10, 1989: Presidential Declaration of Major Disaster, incorporated sixteen local declarations and applied to all communities on Yukon, Kuskokwim and Kobuk rivers and their tributaries. Provided public and individual assistance to repair damage.

Fairbanks/North Star Borough, Emmonak, McGrath, Red Devil, Anvik, Grayling, Newtok, Holy Cross, Alakanuk, Shageluk, Galena. The Governor declared on May 3-23, 1991 FEMA declared May 30, 1991: Flooding. Record snowfalls in the interior combined with sudden spring melt caused flooding all along the Yukon and Kuskokwim River systems. Numerous State Declarations were combined into a single Presidential Declaration of Major Disaster (FEMA-0909-AK) that authorized assistance for repair of public property only. State Disaster Relief Funds were used to implement the Individual and Family Grant Program in all of the communities included in the federal declaration.

Yukon Kuskokwim Delta: On June 5, 1995, the Governor declared a condition of disaster emergency in the Cities of Akiak, Kwethluk, Napaskiak, Newtok, and Alakanuk, as a result of inundation. As a result of this disaster, roads, boardwalks, and other public works essential to vital community services were damaged.

02 Interior Floods (AK-DR-1423) Declared May 29, 2002 by Gov Knowles then FEMA Declared (DR-1423) on June 26 2002: Flooding occurred in various interior and western Alaska river drainages, including the Tanana, Kuskokwim, Nushagak, Susitna and Yukon River drainages beginning on April 27, 2002 and continuing. The floods caused widespread damage to and loss of property in the Fairbanks North Star Borough (Tanana River drainage); in McGrath, Lime Village, Sleetmute, Red Devil, Crooked Creek, Newtok and Kwethluk (Kuskokwim River drainage); Ekwok and New Stuyahok (Nushagak River drainage); in the Susitna River drainage from Chase to Montana

Creek; and in Newtok (Yukon River drainage). The following conditions existed as a result of this disaster: widespread damage to public facilities and infrastructure, including damage to public airports, roads, and buildings; to public utilities, including water, sewer, and electrical utilities; to personal residences, in some areas requiring evacuation and sheltering of residents; to commercial operations; and to other public and private real and personal property.

September 22, 23, 2005. A flood occurred that completely enclosed the village, effectively making it an island for several days. Several houses were only connected to the village via temporarily floating boardwalk. Please see slide show on the CD for pictures from this event, provided by the Newtok Traditional Council.

2005 West Coast Storm declared October 24, 2005 by Governor Murkowski then FEMA declared (DR-1618) on December 9, 2005: Beginning on September 22, 2005 and continuing through September 26, 2005, a powerful fall sea storm produced high winds combined with wind-driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property in the Northwest Arctic Borough, and numerous communities within the Bering Strait (REAA 7), the Kashunamiut (REAA 55), the Lower Yukon (REAA 32) and the Lower Kuskokwim (REAA 31) Rural Education Attendance Areas including the cities of Nome, Kivalina, Unalakleet, Golovin, Tununak, Hooper Bay, Chevak, Mekoryuk and Napakiak. The following conditions existed as a result of this disaster: severe damage to personal residences requiring evacuation and sheltering of the residents; to businesses; to drinking water systems, electrical distribution systems, local road systems, airports, seawalls, and other public infrastructure; and to individual personal and real property; necessitating emergency protective measures and temporary and permanent repairs.

2006 Spring Floods (AK-06-218) declared June 27, 2006 by Governor Murkowski then FEMA declared (DR-1657) on August 04, 2006: Beginning May 5, 2006 continuing through May 30, 2006, the National Weather Service (NWS) issued flooding warnings and watches across the state as excessive snowmelt and ice jams caused flooding along the Yukon, Kuskokwim, and Koyukuk River drainages. The most serious impacts were reported in the communities of Hughes, Koyukuk, Kwethluk, Alakanuk, and Newtok, along with substantial damage to State-maintained airports, roads, and highways. In each community, large portions of the village, village infrastructure, and several roads were inundated and eroded by the floodwaters.

Vulnerability Assessment for Flooding/Erosion

Erosion Issues in Newtok

In 1983-84, Woodward-Clyde Consultants (now URS Corporation) conducted an assessment of Ninglick River erosion in proximity to the village of Newtok. The purpose of the assessment was to evaluate the causes and rates of the erosion, as well as to examine potential mitigation of the impact of river advancement on the village. This study is the only in-depth evaluation of this problem.

According to Woodward-Clyde, the main variables affecting erosion of the bank of the Ninglick River in the area around Newtok include a combination of temperature changes, wave action, and river current. Since the soils in the area have a high ice content, the summer heating of the river edge and associated substrate results in the loss of soil structure caused by interstitial ice degradation. This enhances erosion capability along the river and is coincident with periods of high potential scouring inputs from the unfrozen Ninglick River. Furthermore, Newtok is geographically situated in an area that is affected by both tidal activity and strong winds. This combination increases the likelihood of shoreline erosion by the impact of twice-daily tides as well as periods of intensified wave action from storm surges and winds.

According to village residents, the recurring summer storms associated with winds from the south and southeast, result in the biggest wave action and tremendously accelerate the rate of riverbank erosion. NTC staff members have measured as much as 25 linear feet lost to erosion after a big storm with winds coming from the south and southeast.

Photo 3. Erosion undercut Ninglick River bank in front of Newtok.

The Ninglick River exhibits a sinuous, meandering pattern typical of rivers in areas of gentle topography. River morphology in general is defined by alternating stretches of erosion and deposition, while meandering rivers are typified by high erosion rates on the outside of bends with deposition on the inside and downstream of bends. Newtok is located on the outside, and slightly downstream, of a significant bend in the Ninglick River. Because of this, the river current in this region causes higher rates of erosion. See the topographic map in Appendix D for a view of the topography described.

Statistical Analysis of the Erosion Rate

Woodward-Clyde performed field measurements over the course of their study from upstream and downstream locations, as well as collecting information from historic data. They concluded an average rate of 79 feet per year could be attributed for advancement of the Ninglick River on the village of Newtok. This average was based on values ranging from 42 to 113 feet per year (excluding noted maximum values of 130 feet per year) along the extent of their study area.

Photo 4. Undercutting effect of Ninglick River at low tide.

During the summer of 2003, the NTC staff and ASCG worked together to update and build on Woodward-Clyde's work in evaluating the impact of erosion from the Ninglick River on the village of Newtok. An in-depth analysis of river channel dynamics and morphology was not possible due to the lack of needed data such as river discharge, sediment load, channel cross-sections, et cetera. However, by building on information compiled from the original Woodward-Clyde assessment, the observations of Council staff and village residents, and the use of available mapping and air photos, ASCG utilized gps to perform statistical analysis and reexamine historic rates of erosion in order to show the magnitude of erosion and model the potential future impact of erosion on the village. The process is described below and the results are shown on the Newtok Shoreline Erosion Map in the map folder.

Newtok Shoreline Erosion Map

USGS topographic maps and digital aerial photos were brought into the GIS and aligned to geographic coordinates. This allowed for location of surface features for reference, for measurements to be made in real-world units, and for the digitization of historic shorelines. Shorelines for 1954, 1983, 1996, and 2002 were generated. The location of a portion of the current (2003) shoreline of the Ninglick River was obtained from GPS coordinates recorded on July 14, 2003. These coordinates were checked against oblique aerial photos taken at the same time and found to be accurate.

Location of these historic shorelines provided the information necessary to calculate rates of erosion over the 49-year data history. Measuring total linear foot retreat of the shoreline between record years and dividing the total loss by the number of intervening years accomplished this. Thus, a simple statistical average was attained for the erosion rate per year. Additional analysis of area loss was performed by creating a grid pattern encompassing all digitized shorelines and then using database calculations of each individual polygon created. This allowed for a "normalization" factor to be applied to the calculated linear rates to attempt to adjust for irregular shoreline patterns. The results of this process determined an apparent exponential erosion rate with significant increases in the eroding capability of the river experienced upstream. This pattern complied with typical river channel morphology that indicates higher rates of erosion nearer to the outside apex of a meander bend. It was found that average rates varied from 36 feet per year on the downstream reach to over 83 feet per year upstream. It was also observed that the average rate of erosion appears to be increasing in the upstream reaches. The average rate of erosion occurring directly in front of the village (at the east end of the barge landing on the Ninglick River) between 1954 and 2003 was measured to be 68 feet per year.

Impact of Erosion on Newtok

As can be seen on the Newtok Shoreline Erosion Map in the Appendix, the loss to erosion has been continuous from the base year of 1954. Residents concur that the erosion has been non-stop, year after year. Erosion has and continues to negatively impact the village in the following areas:

- Loss of facilities
- Diminished river access to the village
- Increased workload in providing services.
- Nuisance Problems
- Deferred community development
- Interrupted subsistence activities
- Social impacts

Below are details of these problems. See the Shoreline Erosion Map for reference.

Village Dump Site

The previous village dumpsite and the boardwalk leading to it, located on the south end of the village, washed into the Ninglick River in 1996 due to erosion. A temporary dumpsite was then established on the east side of the Newtok River, across from the village. The dump site is accessible only at high tide, which means that garbage is often piled up on docks waiting to be transported.

Barge Landing and Container Storage Area

Photo 5. Barge Container Threaten by Erosion

The existing barge landing and container storage area located south of the village on the Ninglick River is being washed away. The advancing river continuously threatens containers and material at the site. There is no other location for the landing. According to Newtok Traditional Council staff, the site has and will continue to be moved back towards the village as the advancement of the river dictates. Please see the pictures folder for a photo of the container area after the September 2005 flood.

Diminished River Access to the Village

The Newtok River forms the eastern boundary of the village. The river was once busy with daily boat traffic in summer and provided easy access to residences and barge off-loading facilities. The Newtok River has become progressively shallower due to the encroachment of the Ninglick River in 1996 The encroachment of the Ninglick River has stopped the flow of the Newtok River, creating a build up of silt. During low tide, the river becomes similar to a mud flat. It is now difficult for boat access to and from the two village boat landings. Barge access in the Newtok River is now limited. Some barges can make it into the river; others can offload freight only at the barge landing 830

feet south of the village on the banks of the Ninglick River. Smaller boats must then haul the freight up the Newtok River at high tide.

Increased Workload in Providing Services

After the village dump located on the Ninglick River was washed away in 1996, a temporary dumpsite was established on the east side of the Newtok River, across from the village. The workload for hauling trash to the new dump has now tripled:

1. The trash is first hauled to the drop off point on the village side of the river.
2. The trash is then ferried by boat across the river (only at high tide).
3. The trash must then be hauled again, to the dumpsite approximately 950 feet away.

Nuisance Problems

Trash that has been hauled to the drop off point at the Newtok River piles up on the village side of the river because transport across the river is only possible at high tide. The close proximity of the drop off point to the village has created a nuisance to nearby residents because of the odor and scattered debris.

Deferred Community Development

Photo 6. Shoreline erosion in Newtok.

The advancing erosion and the current and future loss and damage to facilities have caused agencies in the past to delay expending capital funds at Newtok. The concern among agencies and the NTC is the substantial investment required to provide much-needed new capital facilities, versus the risk involved considering the Ninglick River advancing upon the village.

Airport improvements and a solid waste master plan have been deferred. The Yukon-Kuskokwim Health Corporation deferred the construction of a new health clinic for several years. Currently there is concern by the Alaska Energy Authority regarding the advancement of erosion on the village and their plans for construction of a new power plant.

Erosion Rate Projections

Projected shorelines at five-year intervals were determined using the average erosion rates along each of the examined stretches of river. The projected annual erosion rate from 2002 is 64 feet per year. The results of this analysis can be seen in the attached Newtok Shoreline Erosion Map located in the map folder. As shown, the map projections indicate the following threatened facilities:

Table 12. Projected Year of Erosion Impact on Newtok Facilities (2003)

THREATENED FACILITY	YEARS FROM 2003 UNTIL IMPACT	IMPACT YEAR
Steam houses and storage structures at south end of village	12	2015
Four houses at the south end of the village	13	2016
Water supply in a small lake just south of the airport	15	2018
High school and elementary school	17	2020
Airport	19	2022

It should be noted that since the five-year intervals are statistically derived averages and have not been calculated based on actual Ninglick River morphologic data, the most conservative erosion rate values were used in these projections. Actual observations by residents and raw, non-averaged data indicate periods of higher erosion rates. The data from 2003 (not included in this analysis) shows a loss of 110 feet prior to the middle of July. Basic river dynamics would indicate that advance of the Ninglick River on Newtok will be greatest from the upstream side with the rate increasing on average each year.

Photo 7. Low-lying marshy, pond areas southeast of the village.

Of great concern to residents is the low-lying, marshy, pond area, southeast of the village where the Ninglick River meets the Newtok River. Residents state that pond areas have eroded much more quickly than other areas in the past. They fear that these pond areas will be overtaken by the Ninglick River faster than the stated erosion projection, and thus village facilities would face erosion from the southeast as well as from the south.

Mertarvik (North End of Nelson Island)

The Mertarvik site is located approximately nine miles southeast of Newtok on the north end of Nelson Island, adjacent to the Baird Inlet. The site satisfied all relocation site criteria and was selected by the NTC and the community in 1994 as the prime site for village relocation. This site has been approved by Newtok residents in several survey polls, and the village started moving to the site 2005. As of the date of this plan there

are three houses at the new site. The Economic Development Administration is in the process of requesting proposals for a barge landing.

The Newtok Planning Group was formed in May 2006 when representatives from State and Federal agencies began meeting to coordinate assistance to the village of Newtok in its relocation to Mertarvik.

The group meets on a regular basis and have a website set up with links to documents and current status reports. The website can be found at:

http://www.dced.state.ak.us/dca/planning/Newtok_Planning_Group_Webpage.htm.

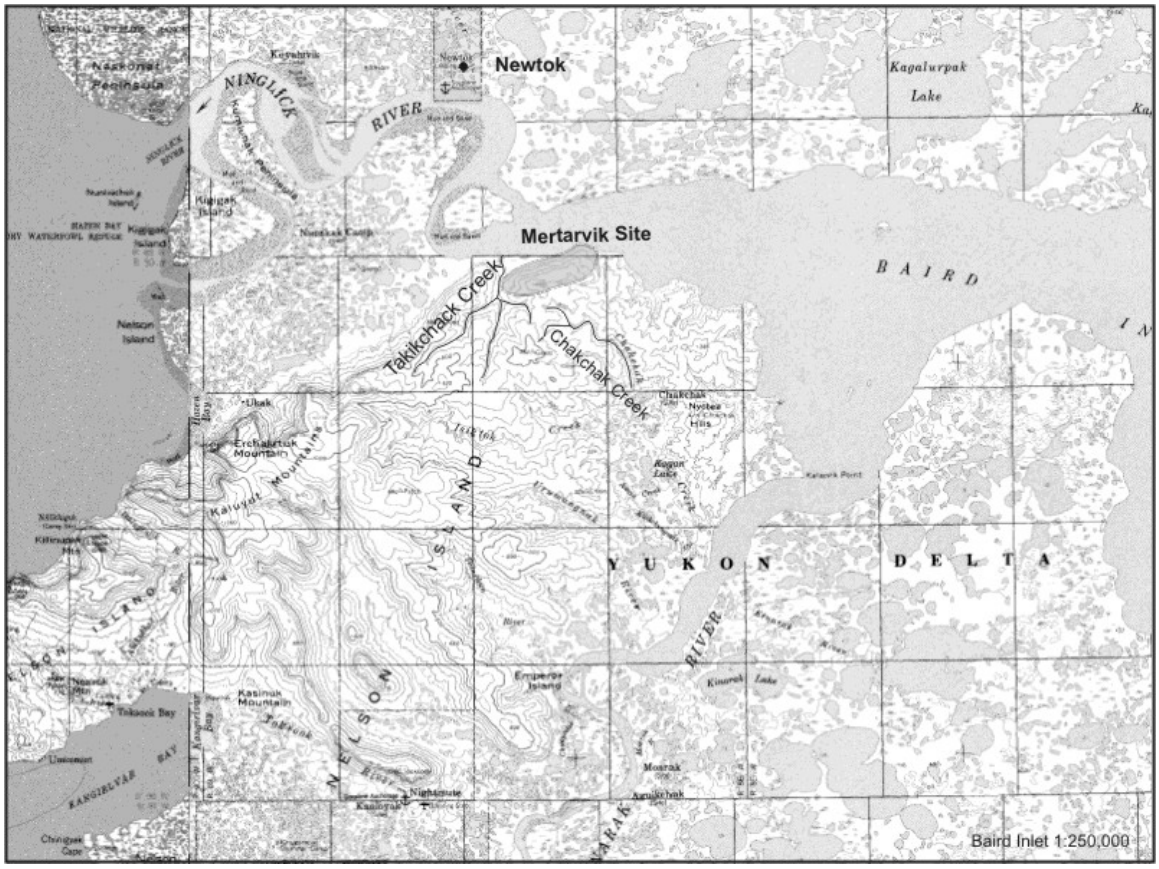
The Denali Commission, Village Safe Water, State of Alaska, National Wildlife Service and the U.S. Army Corps of Engineers, including others, have all been involved in the relocation effort. Draft community layouts of the new village are in process of being developed and water/sewer systems are being designed. Preliminary layouts of the new site may be viewed at the above mentioned website.

Photo 8. Mertarvik Site on Nelson Island (DCRA Photo)

The NTC staff was concerned that all current travel destinations from Newtok could easily be accessed from the Mertarvik site. In 2003, ASCG developed a map for the NTC that shows current regional winter trails and planned trail linkages for relocation. Additional subsistence trails from the new site were also identified Please see this map in the Map folder of this plan.
The overall climate at Mertarvik is similar to Newtok with minor differences in because the topography at Mertarvik is drier and higher in elevation than at Newtok, and some localized areas might experience slightly warmer temperatures in the spring and summer because of solar absorption and protection from wind.

Photo 9. Barge delivery of BIA Housing Improvement Program packages to Mertarvik

Figure 1. The general location of the Mertarvik site relative to the existing community of Newtok, Alaska (USGS Baird Inlet 1:250,000).



The Mertarvik site is 600 feet above sea level and therefore not subject to flooding or erosion. The site vulnerability to other natural hazards is the same as for Newtok in Chapter 3 of this plan.

Flood and Erosion Mitigation Goals and Projects

Goals

Goal 1. Reduce flood damage.

Support elevation, flood proofing, buyout or relocation of structures that are in danger of flooding or are located on eroding banks.

Goal 2. Prevent future flood damage.

Consider the benefits and costs of joining the National Flood Insurance Program.

Goal 3: Increase public awareness

Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards.

Flood/Erosion Projects

Because of the imminent danger, immediate efforts are being undertaken by the village, state and federal agencies to relocate Newtok to Mertarvik. Therefore, the only mitigation projects of substantive benefit to the community are: (1) assistance in moving structures to the new site; and, (2) short term protection for infrastructure currently in Newtok.

Please see Table 14, Mitigation Projects, for more information on the following projects. Woodward-Clyde investigated possible mitigation of the erosion problem and offered several alternatives. These alternatives included the use of soil/cement filled geo-fabric bags for soil improvement, rip-rapping for bank stabilization; the construction of spur dikes to impede the effects of channel flow; and the dredging of a cutoff channel. The main concerns with potential mitigation centered on the location and use of available resources, cost of construction, and the ongoing cost/benefit of any solution due to maintenance concerns well into the future. The poor quality and availability of local materials (specifically soils and rock) and the inordinate expense of construction mobilization/demobilization to this remote part of the state were two major precluding factors for each alternative.

One mitigation project took place in 1987, when the village with the help of the U.S, Army Corps of Engineers attempted to slow the process of erosion with an experimental seawall project. Canvas bags filled with cement and Styrofoam were placed along the riverbank, but the material eventually washed away.

Ultimately, the question of whether any of the mitigation alternatives would reduce the erosion problem enough to secure village habitation for a sustained period could not reasonably be answered due to the assortment of environmental and other variables.

A final alternative was presented by Woodward-Clyde; that of village relocation to a site on Nelson Island, southeast of the current village location. Relocation was considered to be more economical in the long-run (although with more initial cost) than the process of bank erosion stabilization over the required large area. The incalculable cost of the personal impact to local residents necessitated deferment of this decision to the residents of Newtok.

ASCG staff met on August 19, 2003 with URS staff (formerly Woodward-Clyde) who had participated in the 1983-84 study to discuss the conclusions of their report (refer to Appendix H for Woodward-Clyde November 29, 1984 assessment letter). URS staff emphasized again that mitigation efforts such as a seawall and other alternatives are not a permanent solution and are not going to solve the erosion problem in Newtok. The alternatives may slow down the erosion process, but would be extremely expensive

to maintain. They concluded that erosion in Newtok is a problem that will never be controlled.

At the writing of this document, in 2007, a regular relocation working group has been formed, three houses have been moved to the new site, and the relocation effort has become a priority for the village and state and federal agencies.

Mitigation projects should focus on facilitating the relocation of the village.

Structure Relocation

Continue to prioritize s list of homes, commercial structures, and critical facilities that are in danger of flooding and/or in erosion danger. Apply pre-disaster mitigation project grant funds to relocate structures.

Public Education

Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards. This would include advising property owners, potential property owners, and visitors about the hazards.

Equipment

The Village of Newtok has been very proactive in taking whatever steps are needed to protect their village and to move to the Mertarvik site. With equipment such as a bobcat, front end loader, 4-wheelers, skiffs and other tools they would be able to protect the existing structures and could be used to relocate to the Mertarvik site.

Barge Landings

The existing barge landings at Newtok need to be repaired and a new barge landing facility is needed at Mertarvik.

Reduce Effects of Hazards on New Buildings and Infrastructure

Incorporate structural and infrastructure methods during relocation. Such as architectural standards and designs which would mitigation damage during natural hazard events.

Section 2. Tundra fire

Hazard Description and Characterization

Wildland fires occur in every state in the country and Alaska is no exception. Each year, between 600 and 800 wildland fires, mostly between March and October, burn across Alaska causing extensive damage.

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. In Alaska, the natural fire regime is characterized by a return interval of 50 to 200 years, depending on the vegetation type, topography and location. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process and the full range of fire management activities is exercised in Alaska to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighter and public safety and welfare, natural and cultural resources threatened, and the other values to be protected dictate the appropriate management response to the fire. Firefighter and public safety is always the first and overriding priority for all fire management activities.

Fires can be divided into the following categories:

Structure fires – originate in and burn a building, shelter or other structure.

Prescribed fires – ignited under predetermined conditions to meet specific objectives, to mitigate risks to people and their communities, and/or to restore and maintain healthy, diverse ecological systems.

Wildland fire – any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland fire use – a wildland fire functioning in its natural ecological role and fulfilling land management objectives.

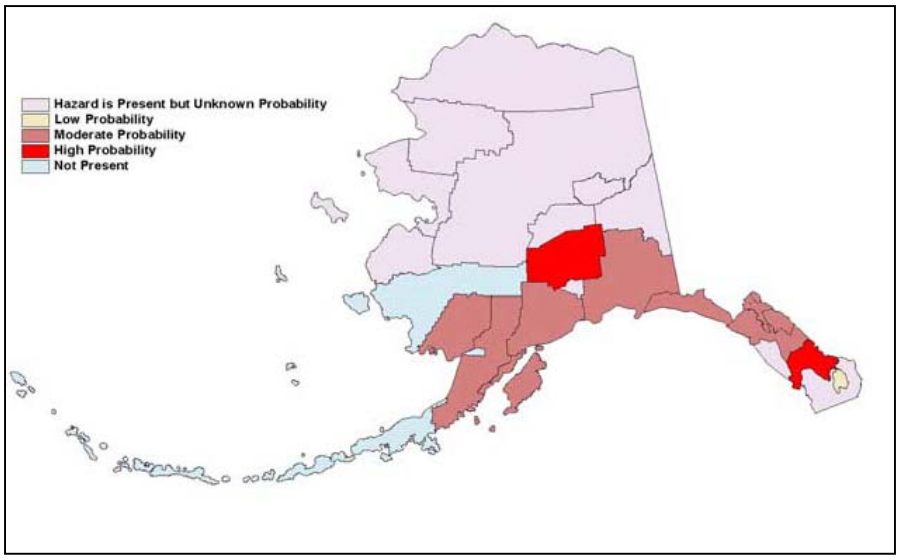
Wildland-urban interface fires – fires that burn within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The potential exists in areas of wildland-urban interface for extremely dangerous and complex fire conditions, which pose a tremendous threat to public and firefighter safety.

Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme causing firewhirls and firestorms that can endanger the lives of the firefighters trying to suppress the blaze. Fuel determines how much energy the fire releases, how quickly the fire spreads and how much effort is needed to contain the fire. Weather is the most variable factor. Temperature and humidity also affect fire behavior. High temperatures and low humidity encourage fire activity while low temperatures and high humidity help retard fire behavior. Wind affects the speed and direction of a fire. Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, like what happens in a canyon, it can lead to faster spreading. Fire can also travel up slope more quickly than down.

Local Tundra Fire Hazard Identification

The following map from the Alaska State Hazard Plan depicts Newtok as being in a an area where fire risk is not present.

Figure 2. Alaska Hazard Plan - Fire Risk Map



Notwithstanding Figure 1, Newtok is located in a full protection area of the state protection option areas. Full protection is suppression action provided on a wildland fire that threatens uninhabited private property, high-valued natural resource areas, and other high-value areas such as identified cultural and historical sites. The suppression objective is to control the fire at the smallest acreage reasonably possible. The allocation of suppression resources to fires receiving the full protection option is second in priority only to fires threatening a critical protection area.

The vegetation of the Ceñaliulriit coastal district is dominated by subarctic wet, moist, and alpine tundra underlain by permafrost. Vegetation communities on the mainland are adapted to permafrost, periodic flooding by tidal or riverine waters, and wind. The periodic flooding favors graminoid-dominated plant communities. Within the Yukon-Kuskokwim Delta National Wildlife Refuge, 38 percent of the vegetation cover is comprised of grass or sedge communities. Other significant vegetation classes in this area include dwarf scrub and peatland complexes; these communities are mixes of dwarf scrub, sphagnum mosses, and tussock-forming grasses. (Ceñaliulriit Coastal Management Plan)

In 1984, the U.S. Fish and Wildlife Service and the U.S. Geological Survey cooperatively surveyed and mapped cover types in the Yukon Delta National Wildlife Refuge using satellite (LANDSAT) imagery. High-altitude photo imagery was used to produce maps on a 1:250,000 scale depicting eighteen vegetation types and six classes

of waters. Within the Yukon Delta refuge, the dominant land cover types are graminoid tussock/dwarf shrub/peatland (19.2 percent), graminoid marsh (18.7 percent), and lichen-dwarf shrub/peatland (12.7 percent).

Tundra Fire Hazard Vulnerability

Please see the Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter. As illustrated by the pictures contained in the power point presentations included with this document and the photos shown in this document there are no tress in Newtok and the low lying ponds and the erosion of Ninglick River make the risk of fire very remote. However, tundra fire is always a concern in Alaska.

Previous Occurrences of Tundra Fire

No previous occurrences of tundra fire have been reported by the village.

Tundra Fire Goals and Mitigation Projects

Goals

Goal 1: Make buildings safer

Goal 2: Conduct outreach activities to encourage the use of Fire Wise techniques.

Goal 3: Encourage the creation of firebreaks.

Goal 4: Encourage the evaluation of emergency plans with respect to tundra fire assessment.

Goal 5: Information acquisition

Projects

Please see Table 14, Mitigation Projects, for more information on the following projects.

Public Education

Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.

Public Safety

Develop or evaluate emergency plans to ensure consistency with tundra fire assessments.

Section 3. Severe Weather

Hazard Description and Characterization

Weather is the result of four main features: the sun, the planet's atmosphere, moisture, and the structure of the planet. Certain combinations can result in severe weather events that have the potential to become a disaster.

In Alaska, there is great potential for weather disasters. High winds can combine with loose snow to produce a blinding blizzard and wind chill temperatures to 75°F below zero. Extreme cold (-40°F to -60°F) and ice fog may last a week at a time. Heavy snow can impact the interior and is common along the southern coast. A quick thaw means certain flooding.

Winter Storms

Winter storms originate as mid-latitude depressions or cyclonic weather systems. High winds, heavy snow, and cold temperatures usually accompany them. To develop, they require:

- Cold air – Subfreezing temperatures (below 32ºF, 0ºC) in the clouds and/or near the ground to make snow and/or ice.
- Moisture – The air must contain moisture in order to form clouds and precipitation.
- Lift – A mechanism to raise the moist air to form the clouds and cause precipitation. Lift may be provided by any or all of the following:
    - The flow of air up a mountainside.
    - Fronts, where warm air collides with cold air and rises over the dome of cold air.
    - Upper-level low pressure troughs.

Heavy Snow

Heavy snow, generally more than 12 inches of accumulation in less than 24 hours, can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and major roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and can knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns. Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents.

Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

Extreme cold

What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Alaska, extreme cold usually involves temperatures below –40ºF. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

Extreme cold can bring transportation to a halt across interior Alaska for days or sometimes weeks at a time. Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies to northern villages.

Extreme cold also interferes with a community's infrastructure. It causes fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity, heaters do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase disturbing buried pipes.

The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Ice Storms

The term "ice storm" is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. They can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages and personal injury. Ice storms result from the accumulation of freezing rain, which is rain that becomes super cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy snow and sleet in other locations.

Freezing rain develops as falling snow encounters a layer of warm air in the atmosphere deep enough for the snow to completely melt and become rain. As the rain continues to fall, it passes through a thin layer of cold air just above the earth's surface and cools to a temperature below freezing. The drops themselves do not freeze, but rather they become super cooled. When these super cooled drops strike the frozen ground, power lines, tree branches, etc., they instantly freeze.

Severe Weather Hazard Identification

Table 13, Newtok Weather Summary, uses statistics from the nearest weather station at the Bethel, Alaska weather station. Source: Western Regional Climate Center, wrcc@dri.edu

Table 13. Newtok Weather Summary

Previous Occurrences

	Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	48	17/1963	-48	28/1989	25.7	1985	-12.9	1989	0.0	25.4	30.4	16.1
February	46	13/1970	-39	02/1954	26.1	1989	-13.2	1984	0.0	21.7	27.7	13.4
March	48	31/1954	-42	01/1956	29.4	1981	-3.1	1966	0.0	22.1	30.6	12.4
April	63	30/2004	-31	05/1956	34.9	1993	8.3	1985	0.0	12.1	28.0	4.4
May	80	31/1993	4	03/1965	48.1	1981	31.0	1964	0.0	1.4	15.4	0.0
June	86	19/1959	28	01/1960	57.8	1957	45.1	1978	0.0	0.0	0.6	0.0
July	86	11/1951	31	17/1959	61.1	2004	50.5	1959	0.0	0.0	0.0	0.0
August	87	09/2003	28	26/1984	59.4	2004	49.0	1969	0.0	0.0	0.1	0.0
September	72	10/1979	18	27/1957	50.2	1995	37.6	1992	0.0	0.1	5.8	0.0
October	65	02/1954	-6	30/2001	36.3	2002	23.4	2001	0.0	10.5	25.5	0.4
November	51	06/2002	-24	30/1990	27.4	1970	2.8	1963	0.0	20.5	28.5	6.6
December	45	21/1963	-41	28/1957	25.3	1985	-10.7	1999	0.0	25.0	30.5	15.7
Annual	**87**	**20030809**	**-48**	**19890128**	**34.3**	**2002**	**24.7**	**1956**	**0.0**	**138.8**	**223.0**	**69.0**
Winter	48	19630117	-48	19890128	21.8	2001	-2.7	1965	0.0	72.1	88.5	45.1
Spring	80	19930531	-42	19560301	36.6	1981	16.5	1972	0.0	35.6	74.0	16.8
Summer	87	20030809	28	19600601	58.8	2004	50.1	1965	0.0	0.0	0.7	0.0
Fall	72	19790910	-24	19901130	36.4	2002	25.2	1956	0.0	31.1	59.7	7.1

As indicated on the table above, Newtok is at most danger from extreme cold. The following severe weather event for the entire state was declared in 1989.

Omega Block Disaster, January 28, 1989 & FEMA declared (DR-00826) on May 10, 1989. The Governor declared a statewide disaster to provide emergency relief to communities suffering adverse effects of a record breaking cold spell, with temperatures as low as -85 degrees. The State conducted a wide variety of emergency actions, which included: emergency repairs to maintain and prevent damage to water, sewer and electrical systems, emergency resupply of essential fuels and food, and the Alaska Department of Transportation and Public Facilities (ADOT/PF) support in maintaining access to isolated communities.

Severe Weather Hazard Vulnerability

Please see Table 10 and description at the beginning of this chapter. Severe weather and heavy rainfall and high winds put Newtok at risk for flooding and erosion.

Severe Weather Mitigation Goals and Projects

Goals

Goal 1: Mitigate the effects of extreme weather by instituting programs that provide early warning and preparation.

Goal 2: Educate people about the dangers of extreme weather and how to prepare.

Goal 3: Develop practical measures to warn in the event of a severe weather event.

Projects

Please see Table 14, Mitigation Projects, for more information on the following projects.

Research and consider instituting the National Weather Service program of *"Storm Ready"*.

Storm Ready is a nationwide community preparedness program that uses a grassroots approach to help communities develop plans to handle all types of severe weather—from tornadoes to tsunamis. The program encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations.

To be officially Storm Ready, a community must:

1. Establish a 24-hour warning point and emergency operations center.
2. Have more than one way to receive severe weather forecasts and warnings and to alert the public.
3. Create a system that monitors local weather conditions.
4. Promote the importance of public readiness through community seminars.
5. Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
6. Demonstrate a capability to disseminate warnings.

Specific Storm Ready guidelines, examples, and applications also may be found on the Internet at: www.nws.noaa.gov/stormready

Weather Radio Station

Expand public awareness about National Oceanographic and Atmospheric Administration (NOAA) Weather Radio for continuous weather broadcasts and warning tone alert capability.

Section 4. Earthquake

Hazard Description and Characterization

Approximately 11 percent of the world's earthquakes occur in Alaska, making it one of the most seismically active regions in the world. Three of the ten largest quakes in the world since 1900 have occurred here. Earthquakes of magnitude 7 or greater occur in Alaska on average of about once a year; magnitude 8 earthquakes average about 14 years between events.

Most large earthquakes are caused by a sudden release of accumulated stresses between crustal plates that move against each other on the earth's surface. Some earthquakes occur along faults that lie within these plates. The dangers associated with earthquakes include ground shaking, surface faulting, ground failures, snow avalanches, seiches and tsunamis. The extent of damage is dependent on the magnitude of the quake, the geology of the area, distance from the epicenter and structure design and construction. A main goal of an earthquake hazard reduction program is to preserve lives through economical rehabilitation of existing structures and constructing safe new structures.

Ground shaking is due to the three main classes of seismic waves generated by an earthquake. Primary waves are the first ones felt, often as a sharp jolt. Shear or secondary waves are slower and usually have a side to side movement. They can be very damaging because structures are more vulnerable to horizontal than vertical motion.

Surface waves are the slowest, although they can carry the bulk of the energy in a large earthquake. The damage to buildings depends on how the specific characteristics of

each incoming wave interact with the buildings' height, shape, and construction materials.

Earthquakes are usually measured in terms of their magnitude and intensity. Magnitude is related to the amount of energy released during an event while intensity refers to the effects on people and structures at a particular place. Earthquake magnitude is usually reported according to the standard Richter scale for small to moderate earthquakes.

Large earthquakes, like those that commonly occur in Alaska are reported according to the moment-magnitude scale because the standard Richter scale does not adequately represent the energy released by these large events.

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from not felt to total destruction. Different values can be recorded at different locations for the same event depending on local circumstances such as distance from the epicenter or building construction practices. Soil conditions are a major factor in determining an earthquake's intensity, as unconsolidated fill areas will have more damage than an area with shallow bedrock. Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting.

Strike-slip faults are where each side of the fault moves horizontally. Normal faults have one side dropping down relative to the other side. Thrust (reverse) faults have one side moving up and over the fault relative to the other side.

Earthquake-induced ground failure is often the result of liquefaction, which occurs when soil (usually sand and course silt with high water content) loses strength as a result of the shaking and acts like a viscous fluid.

Liquefaction causes three types of ground failures: lateral spreads, flow failures, and loss of bearing strength. In the 1964 earthquake, over 200 bridges were destroyed or damaged due to lateral spreads. Flow failures damaged the port facilities in Seward, Valdez and Whittier.

Similar ground failures can result from loss of strength in saturated clay soils, as occurred in several major landslides that were responsible for most of the earthquake damage in Anchorage in 1964. Other types of earthquake-induced ground failures include slumps and debris slides on steep slopes.

Local Earthquake Hazard Identification

The following figures were obtained from the University of Alaska, Fairbanks, and Alaska Earthquake Information Center website at: http://www.giseis.alaska.edu/Seis/

The tables and other information at the website list the Newtok area as having a low probability of an earthquake. All of Alaska is at risk for an earthquake event Newtok

could be at risk for an earthquake or have secondary impact from an earthquake in the region.

Previous Occurrences of Earthquakes

The Village of Newtok staff and elders have stated that to their knowledge an earthquake has not caused any damage in the Newtok area, however, the danger always exists in Alaska.

Figure 3. Alaska Earthquake Information System

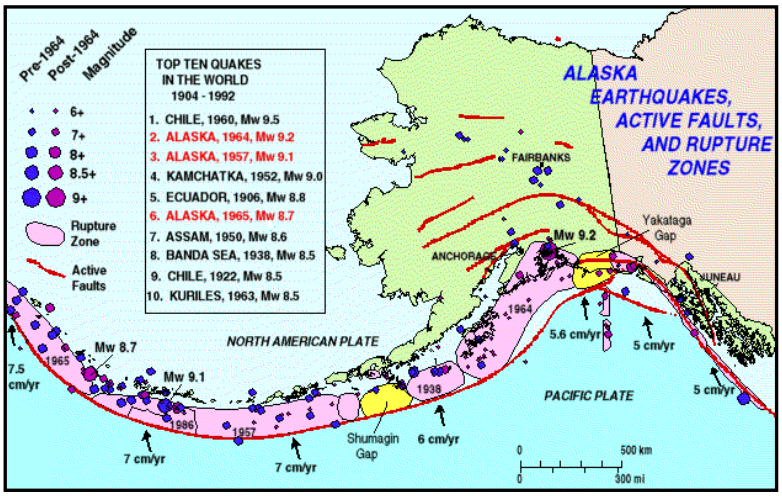
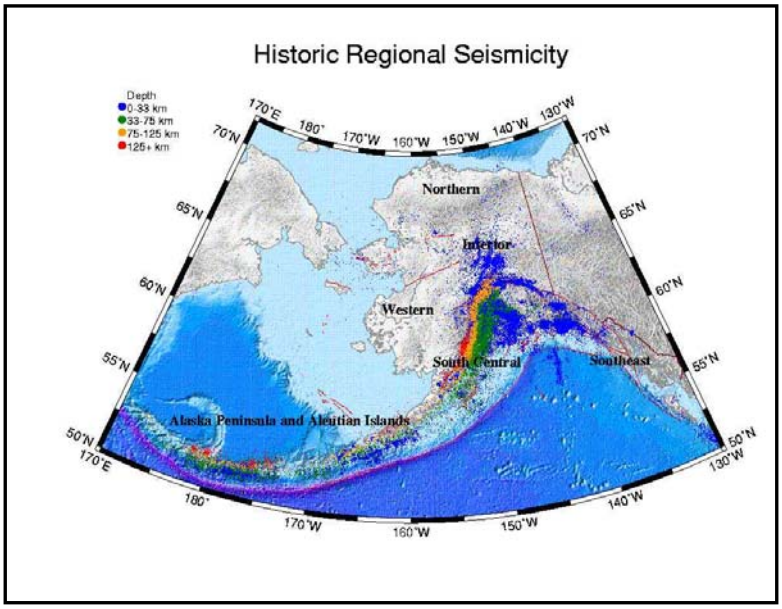


Figure 4. AEIS Historic Regional Seismicity



Source: University of Alaska, Fairbanks, and Alaska Earthquake Information Center website at: http://www.giseis.alaska.edu/Seis/

Earthquake Hazard Vulnerability

Please see Table 10 and description at the beginning of this chapter.

Earthquake Hazard Goals and Mitigation Projects

Goals

Goal 1: Obtain funding to protect existing critical infrastructure from earthquake damage.

Projects

Please see Table 14, Mitigation Projects, for more information on the following projects.

Critical Structures

Identify buildings and facilities that must be able to remain operable during and following an earthquake event.

Section 5. Description of Hazards Not Present in Newtok

Avalanche, Landslides and Volcanoes

Newtok is located on a flat floodplain with a gentle topographic relief in the village estimated to be 10 to 12 feet. There is no danger from avalanches, landslides or volcanoes because there are no mountains or steep slopes in the village.

Tsunamis and Seiches

There is no danger of tsunamis and seiches since Newtok is located ten miles inland from the Bering Sea.

Chapter 4: Mitigation Strategy

Benefit - Cost Review

This chapter of the plan outlines Newtok's overall strategy to reduce its vulnerability to the effects of the hazards studied. Currently the planning effort is limited to the hazards determined to be of the most concern; flooding, erosion, severe weather and earthquake; however the mitigation strategy will be regularly updated as additional hazard information is added and new information becomes available.

The projects listed on the following Benefit and Costs Listing Table, were prioritized using a listing of benefits and costs review method as described in the FEMA *How-To-Guide Benefit-Cost Review in Mitigation Planning* (FEMA 386-5).

Due to monetary as well as other limitations, it is often impossible to implement all mitigation actions. Therefore, the most cost-effective actions for implementation will be pursued for funding first, not only to use resources efficiently, but also to make a realistic start toward mitigating risks.

The City of Newtok considered the following factors in prioritizing the mitigation projects. Due to the dollar value associated with both life-safety and critical facilities, the prioritization strategy represents a special emphasis on benefit-cost review because the factors of life-safety and critical facilities steered the prioritization towards projects with likely good benefit-cost ratios.

1. Extent to which benefits are maximized when compared to the costs of the projects, the Benefit Cost Ratio must be 1.0 or greater.

2. Extent the project reduces risk to life-safety.

3. Project protects critical facilities or critical city functionality.

    A. Hazard probability.

    B. Hazard severity.

Other criteria that was used to developing the benefits – costs listing depicted on the Cost Benefit Review Listing table:

1. Vulnerability before and after Mitigation

Number of people affected by the hazard, areawide, or specific properties.
Areas affected (acreage) by the hazard
Number of properties affected by the hazard
Loss of use

Loss of life (number of people)
Injury (number of people)

1. List of Benefits

Risk reduction (immediate or medium time frame)
Other community goals or objectives achieved
Easy to implement
Funding available
Politically or socially acceptable

2. Costs

Construction cost
Programming cost
Long time frame to implement
Public or political opposition
Adverse environmental effects

This method supports the principle of benefit-cost review by using a process that demonstrates a special emphasis on maximization of benefits over costs. Projects that demonstrate benefits over costs and that can start immediately were given the highest priority. Projects that the costs somewhat exceed immediate benefit and that can start within five years (or before the next update) were given a description of medium priority, with a timeframe of one to five years. Projects that are very costly without known benefits, probably cannot be pursued during this plan cycle, but are important to keep as an action were given the lowest priority and designated as long term.

The Newtok Planning Commission will hold another round of public meetings on the LHMP Update. The plan is subject to final Newtok Tribal Council approval after pre-approval is obtained by DHS&EM.

After the LHMP Update has been approved, the projects must be evaluated using a Benefit-Cost Analysis (BCA) during the funding cycle for disaster mitigation funds from DHS&EM and FEMA.

A description of the BCA process follows, briefly, BCA is the method by which the future benefits of a mitigation project are determined and compared to its cost. The result is a Benefit-Cost Ratio, which is derived from a project's total net benefits divided by its total cost. The BCR is a numerical expression of the cost-effectiveness of a project. Composite BCRs of 1.0 or greater have more benefits than costs, and are therefore cost-effective.

Benefit-Cost Review vs. Benefit-Cost Analysis (FEMA 386-5) states in part:
Benefit-Cost Review for mitigation planning differs from the benefit cost analysis (BCA) used for specific projects. BCA is a method for determining the potential positive effects of a mitigation action and comparing them to the cost of the action. To assess and demonstrate the cost-effectiveness of mitigation actions, FEMA has developed a suite of BCA software, including hazard-specific modules. The analysis determines whether a mitigation project is technically cost-effective. The principle behind the BCA is that the benefit of an action is a reduction in future damages.

DMA 2000 does not require hazard mitigation plans to include BCA's for specific projects, but does require that a BCR be conducted in prioritizing projects.

Benefit-Cost Analysis

The following section is reproduced from a document prepared by FEMA, which demonstrates on how to perform a Benefit –Cost Analysis. The complete guidelines document, a benefit-cost analysis document and benefit-cost analysis technical assistance is available online http://www.fema.gov/government/grant/bca.

Facilitating BCA

Although the preparation of a BCA is a technical process, FEMA has developed software, written materials, and training that simplifies the process of preparing BCAs. FEMA has a suite of BCA software for a range of major natural hazards: earthquake, fire (wildland/urban interface fires), flood (riverine, coastal A-Zone, Coastal V-Zone), Hurricane Wind (and Typhoon), and Tornado.

Sometimes there is not enough technical data available to use the BCA software mentioned above. When this happens, or for other common, smaller-scale hazards or more localized hazards, BCAs can be done with the Frequency Damage Method (i.e., the Riverine Limited Data module), which is applicable to any natural hazard as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a result of the event. This approach can be used for coastal storms, windstorms, freezing, mud/landslides, severe ice storms, snow, tsunami, and volcano hazards.

Applicants and Sub-Applicants must use FEMA-approved methodologies and software to demonstrate the cost-effectiveness of their projects. This will ensure that the calculations and methods are standardized, facilitating the evaluation process. Alternative BCA software may also be used, but only if the FEMA Regional Office and FEMA Headquarters approve the software.

To assist Applicants and Sub-applicants, FEMA has prepared the *FEMA Mitigation BCA Toolkit* CD. This CD includes all of the FEMA BCA software, technical manuals, BC training courses, Data-Documentation Templates, and other supporting documentation and guidance.

The *Mitigation BCA Toolkit* CD is available free from FEMA Regional Offices or via the BC Helpline (at bchelpline@dhs.gov or toll free number at (866) 222-3580.

HAZARD EVENT (Frequency & Severity)	**X**	PROPERTY EXPOSED TO THE HAZARD	**=**	HAZARD RISK Dollars ($$)
Probability of Damaging Hazard Events		Value & Vulnerability of Property Exposed to the Hazard		Severity of the Hazard Threat to the Built Environment

The BC Helpline is also available to provide BCA software, technical manuals, and other BCA reference materials as well as to provide technical support for BCA.

For further technical assistance, Applicants or Sub-Applicants may contact their State Mitigation Office, the FEMA Regional Office, or the BC Helpline. FEMA and the BC Helpline provide technical assistance regarding the preparation of a BCA.

Benefit and Cost Review Listing Table

Table 14. Benefit Cost Review Listing

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented, 0 – 1 year.
Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.
Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

Mitigation Projects	Benefit (pros)	Costs (cons)	Priority*
Mertarvik Relocation Projects			
Mertarvik Planning Group Projects. Support projects that provide mitigation measures from natural hazards of Severe Weather, Earthquake, Tundra Fire at new Village site. Flooding and erosion hazards will not be a factor at new site. Please see Appendix for specific activities from the Newtok Planning Group.	Benefit to entire community. Life/safety and health issues. Some projects can be implemented immediately. Political support at local, state and federal level.	Complicated logistical and social issues. Extremely expensive. See Appendix for further information and costs.	High
Flood/Erosion Projects (FLD)			
FLD-1. Structure and Infrastructure Relocation	Benefit to entire community. Political support. Can and should be implemented immediately. Life/Safety/Health issues.	Complicated logistical and social issues. Extremely expensive. See Appendix for further information and costs.	High
FLD-2. Public Education	Benefit to entire community. Ongoing issue in Newtok	Interest from community members not determined.	Medium

Mitigation Projects	Benefit (pros)	Costs (cons)	Priority*
FLD-3. Equipment. Bobcat, front-end loader, 4-wheelers, skiffs and other tools to protect the existing structures and facilitate relocation efforts.	Benefit to entire community. Can be implemented immediately. Some of the equipment is relatively inexpensive compared to the benefit.	Logistics involved in barging in the equipment.	High
FLD-4. Barge Landings The existing barge landings at Newtok need to be repaired and a new barge landing facility is needed at Mertarvik.	Benefit to entire community. Barge essential to life/safety of community. 1 – 5 years to implement.	Expensive	Medium
Tundra Fire Projects (TF)			
TF-1. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Benefit to specific properties. Tundra fire risk is low. Simple measures could greatly benefit properties.	Expertise in tundra fire and prevention not determined. May require state assistance.	Low
TF-2. Develop or evaluate emergency plans to ensure consistency with tundra fire assessments.	Benefit to entire community.	May require state assistance.	Low
Severe Weather (SW)			
SW-1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
SW-2. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Projects	Benefit (pros)	Costs (cons)	Priority*
Earthquake Hazard (EQ)			
EQ-1. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
EQ-2. Critical Structures. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Strategy Project Table

Table 15. Mitigation Strategy Project Table

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented, 0 – 1 year.
Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.
Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

** PDMG Pre-Disaster Mitigation Grant

*** HMGP Hazard Mitigation Grant Program

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority* Estimated Timeframe
Mertarvik Relocation Projects				
Mertarvik Planning Group Projects. Support projects that provide mitigation measures from natural hazards of Severe Weather, Earthquake, Tundra Fire at new Village site. Flooding and erosion hazards will not be a factor at new site. Please see Appendix for specific activities from the Newtok Planning Group.	Newtok Planning Group DHS&EM, FEMA, USCOE DCRA	>$1 million	PDMG** HMGP*** Federal and state assistance	High Immediate

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority* Estimated Timeframe
Flood/Erosion Projects (FLD)				
FLD-1. Structure and Infrastructure Relocation	Tribal Council State of Alaska USCOE FEMA	To be Determined > 1 million	State USCOE Denali Com PDMG** HMGP***	High Immediate
FLD-2. Public Education	Tribe DCCED	Staff Time	DCCED Grant	Medium 0 – 5 years
FLD-3. Equipment. Bobcat, front-end loader, 4-wheelers, skiffs and other tools to protect the existing structures and facilitate relocation efforts.	Tribal Council State of Alaska USCOE FEMA	To be Determined > $10,000	State USCOE Denali Com PDMG* HMGP***	High Immediate
FLD-4. Barge Landings The existing barge landings at Newtok need to be repaired and a new barge landing facility is needed at Mertarvik.	Federal Government	To be Determined RFP in process	EDA	High Immediate
Tundra Fire Projects (TF)				
TF-1. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Tribe State Div of Forestry	NA	State Grants	>1 year
TF-2. Develop or evaluate emergency plans to ensure consistency with tundra fire assessments.	Tribe State Div of Forestry	NA	State Grant	>1 year
Severe Weather (SW)				
SW-1. Research and consider instituting the National Weather Service program of “Storm Ready”.	Tribe	Staff Time	DCCED	<1 year

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority* Estimated Timeframe
SW-2. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.	Tribe	Staff Time	NOAA	Ongoing
Earthquake Hazard (EQ)				
EQ-1. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Tribe DHS&EM DCCED	Staff Time	State Grant	<1 year
EQ-2. Critical Structures. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Tribe DHS&EM	Staff Time	State Grant	<1 year

Glossary of Terms

A-Zones

Type of zone found on all Flood Hazard Boundary Maps (FHBMs), Flood Insurance Rate Maps (FIRMs), and Flood Boundary and Floodway Maps (FBFMs).

Acquisition

Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

Asset

Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood

A term used in the National Flood Insurance Program to indicate the minimum size of a flood. A community as a basis for its floodplain management regulations uses this information. It is the level of a flood, which has a one-percent chance of occurring in any given year. Also known as a 100-year flood elevation or one-percent chance flood.

Base Flood Elevation (BFE)

The elevation for which there is a one-percent chance in any given year that floods water levels will equal or exceed it. The BFE is determined by statistical analysis for each local area and designated on the Flood Insurance Rate Maps. It is also known as 100-year flood elevation.

Base Floodplain

The area that has a one percent chance of flooding (being inundated by flood waters) in any given year.

Building

A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Code

The regulations adopted by a local governing body setting forth standards for the construction, addition, modification, and repair of buildings and

other structures for the purpose of protecting the health, safety, and general welfare of the public.

Community

Any state, area or political subdivision thereof, or any Indian tribe or tribal entity that has the authority to adopt and enforce statutes for areas within its jurisdiction.

Community Rating System (CRS)

The Community Rating System is a voluntary program that each municipality or county government can choose to participate in. The activities that are undertaken through CRS are awarded points. A community's points can earn people in their community a discount on their flood insurance premiums.

Critical Facility

Facilities that are critical to the health and welfare of the population and that are especially important during and after a hazard event. Critical facilities include, but are not limited to, shelters, hospitals, and fire stations.

Designated Floodway

The channel of a stream and that portion of the adjoining floodplain designated by a regulatory agency to be kept free of further development to provide for unobstructed passage of flood flows.

Development

Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or of equipment or materials.

Digitize

To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table coordinates) for use in computer

Disaster Mitigation Act (DMA)

DMA 2000 (public Law 106-390) is the latest legislation of 2000 (DMA 2000) to improve the planning process. It was signed into law on October 10, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

Earthquake

A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the earth's tectonic plates.

Elevation

The raising of a structure to place it above flood waters on an extended support structure.

Emergency Operations Plan

A document that: describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated.

Erosion

The wearing away of the land surface by running water, wind, ice, or other geological agents.

Federal Disaster Declaration

The formal action by the President to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended. Same meaning as a Presidential Disaster Declaration

Federal Emergency Management Agency (FEMA)

A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flood

A general and temporary condition of partial or complete inundation of water over normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Disaster Assistance

Flood disaster assistance includes development of comprehensive preparedness and recovery plans, program capabilities, and organization of Federal agencies and of State and local governments to mitigate the adverse effects of disastrous floods. It may include maximum hazard reduction, avoidance, and mitigation measures, as well policies, procedures, and eligibility criteria for Federal grant or loan assistance to State and local governments, private organizations, or individuals as the result of the major disaster.

Flood Elevation

Elevation of the water surface above an establish datum (reference mark), e.g. National Geodetic Vertical Datum of 1929, North American Datum of 1988, or Mean Sea Level.

Flood Hazard

Flood Hazard is the potential for inundation and involves the risk of life, health, property, and natural value. Two reference base are commonly used: (1) For most situations, the Base Flood is that flood which has a one-percent chance of being exceeded in any given year (also known as the 100-year flood); (2) for critical actions, an activity for which a one-percent chance of flooding would be too great, at a minimum the base flood is that flood which has a 0.2 percent chance of being exceeded in any given year (also known as the 500-year flood).

Flood Insurance Rate Map

Flood Insurance Rate Map (FIRM) means an official map of a community, on which the Administrator has delineated both the special hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study

Flood Insurance Study or Flood Elevation Study means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluations and determination of mudslide (i.e., mudflow) and/or flood-related' erosion hazards.

Floodplain

A "floodplain" is the lowland adjacent to a river, lake, or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood. The 100-year floodplain by the 100-year flood.

Floodplain Management

The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain Management Regulations

Floodplain Management Regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof,

which provide standards for the purpose of flood damage prevention and reduction.

Flood Zones

Zones on the Flood Insurance Rate Map (FIRM) in which a Flood Insurance Study has established the risk premium insurance rates.

Flood Zone Symbols

A - Area of special flood hazard without water surface elevations determined.
A1-30 - AE Area of special flood hazard with water surface elevations determined.
AO - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet.
A-99 - Area of special flood hazard where enough progress has been made on a protective system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes.
AH - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet and with water surface elevations determined.
B - X Area of moderate flood hazard.
C - X Area of minimal hazard.
D - Area of undetermined but possible flood hazard.

Geographic Information System

A computer software application that relates physical features of the earth to a database that can be used for mapping and analysis.

Governing Body

The legislative body of a municipality that is the assembly of a borough or the council of a city.

Hazard

A source of potential danger or adverse condition. Hazards in the context of this plan will include naturally occurring events such as floods, earthquakes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

Any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. (44 CFR Subpart M 206.401)

Hazard Mitigation Grant Program

The program authorized under section 404 of the Stafford Act, which may provide funding for mitigation measures identified through the evaluation of natural hazards conducted under §322 of the Disaster Mitigation Act 2000.

Hazard Profile

A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard and Vulnerability Analysis

The identification and evaluation of all the hazards that potentially threaten a jurisdiction and analyzing them in the context of the jurisdiction to determine the degree of threat that is posed by each.

Mitigate

To cause something to become less harsh or hostile, to make less severe or painful.

Mitigation Plan

A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the State and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance

The Federal program, created by an act of Congress in Program (NFIP) 1968 that makes flood insurance available in communities that enact satisfactory floodplain management regulations.

One Hundred (100)-Year

The flood elevation that has a one-percent chance of occurring in any given year. It is also known as the Base Flood.

Planning

The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Repetitive Loss Property

A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10-year period since 1978.

Risk

The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It can also be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine

Relating to, formed by, or resembling rivers (including tributaries), streams, creeks, brooks, etc.

Riverine Flooding

Flooding related to or caused by a river, stream, or tributary overflowing its banks due to excessive rainfall, snowmelt or ice.

Runoff

That portion of precipitation that is not intercepted by vegetation, absorbed by land surface, or evaporated, and thus flows overland into a depression, stream, lake, or ocean (runoff, called immediate subsurface runoff, also takes place in the upper layers of soil).

Seiche

An oscillating wave (also referred to as a seismic sea wave) in a partially or fully enclosed body of water. May be initiated by landslides, undersea landslides, long period seismic waves, wind and water waves, or a tsunami.

Seismicity

Describes the likelihood of an area being subject to earthquakes.

State Disaster Declaration

A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation.

Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster areas. It is required before a Presidential Disaster Declaration can be requested.

Topography

The contour of the land surface. The technique of graphically representing the exact physical features of a place or region on a map.

Tribal Government

A Federally recognized governing body of an Indian or Alaska native Tribe, band, nation, pueblo, village or community that the Secretary of the Interior acknowledges to exist as an Indian tribe under the Federally Recognized Tribe List Act of 1994, 25 U.S.C. 479a. This does not include Alaska Native corporations, the ownership of which is vested in private individuals.

Tsunami

A sea wave produced by submarine earth movement or volcanic eruption with a sudden rise or fall of a section of the earth's crust under or near the ocean. A seismic disturbance or landslide can displace the water column, creating a rise or fall in the level of the ocean above. This rise or fall in sea level is the initial formation of a tsunami wave.

Vulnerability

Describes how exposed or susceptible to damage an asset it. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment

The extent of injury and damage that may result from hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Watercourse

A natural or artificial channel in which a flow of water occurs either continually or intermittently.

Watershed

An area that drains to a single point. In a natural basin, this is the area contributing flow to a given place or stream.

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6. *FEMA Benefit-Cost Analysis Website:* http://www.fema.gov/government/grant/bca.

7. FEMA How to Guides

   Getting Started: Building Support For Mitigation Planning (FEMA 386-1)

   Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)

   Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)

   Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)

   Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

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http://www.dced.state.ak.us/dca/planning/Newtok_Planning_Group_Webpage.htm.

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Web Sites

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org
Developing the Implementation Strategy:	www.pro.gov.uk
Federal Emergency Management Agency:	http://www.fema.gov/fima/planning.shtm
Community Rating System:	http://www.fema.gov/nfip/crs.htm
Flood Mitigation Assistance Program:	http://www.fema.gov/fima/planfma.shtm
Hazard Mitigation Grant Program:	http://www.fema.gov/fima/hmgp
Individual Assistance Programs:	http://www.fema.gov/rrr/inassist.shtm
Interim Final Rule:	http://www.access.gpo.govl
National Flood Insurance Program:	http://www.fema.gov/nfip
Public Assistance Program:	http://www.fema.gov/rrr/pa

Appendix

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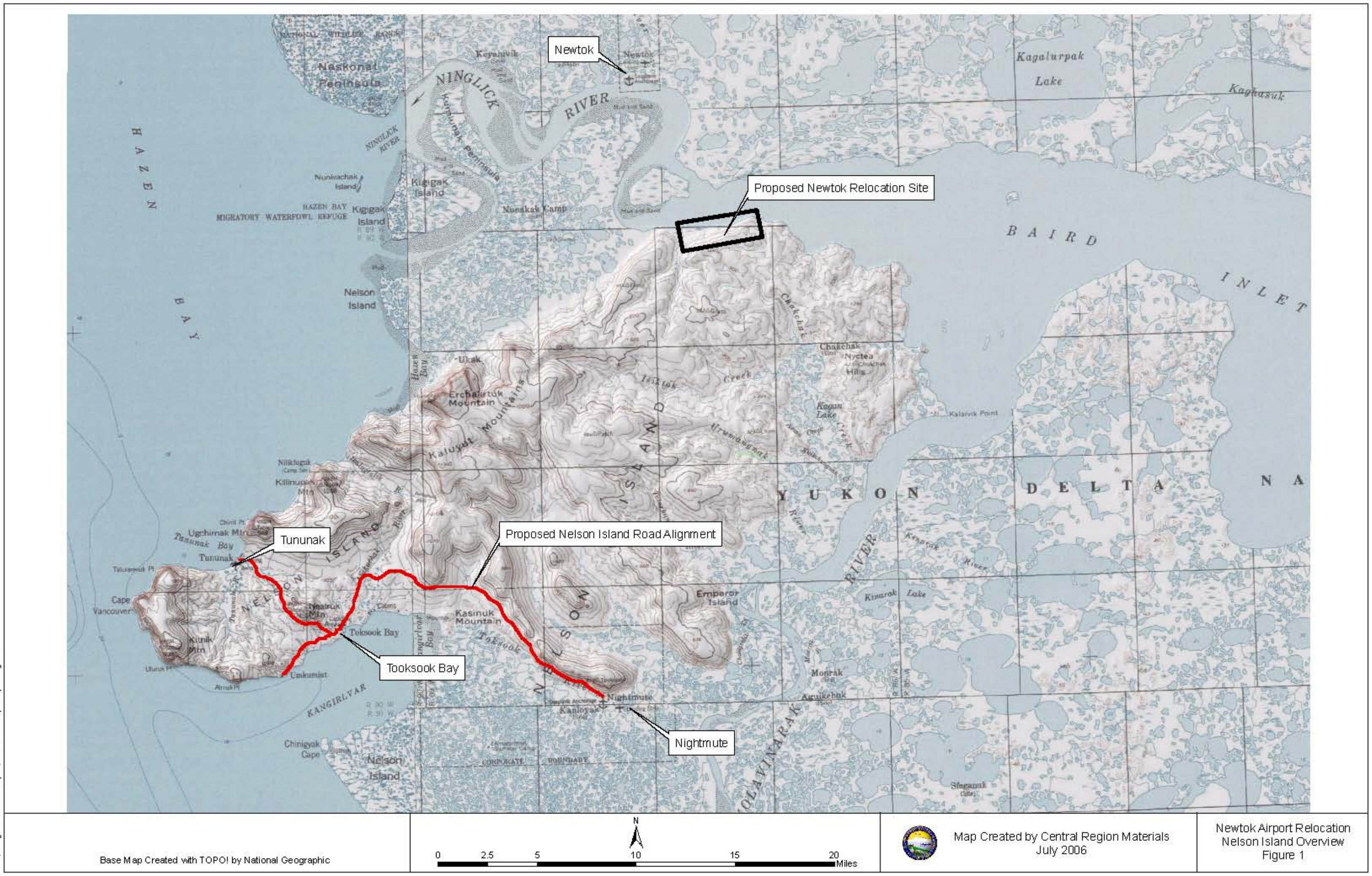
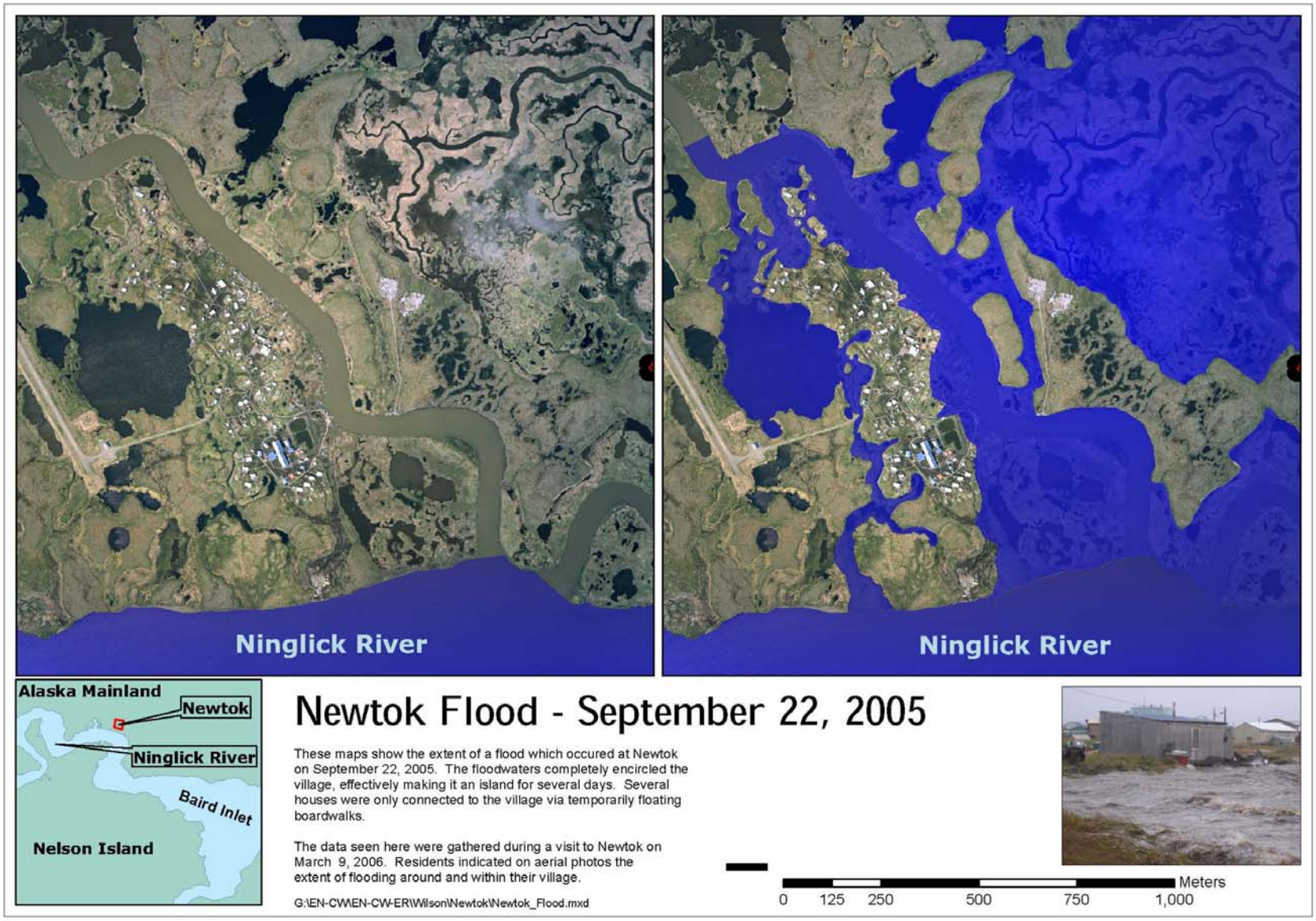
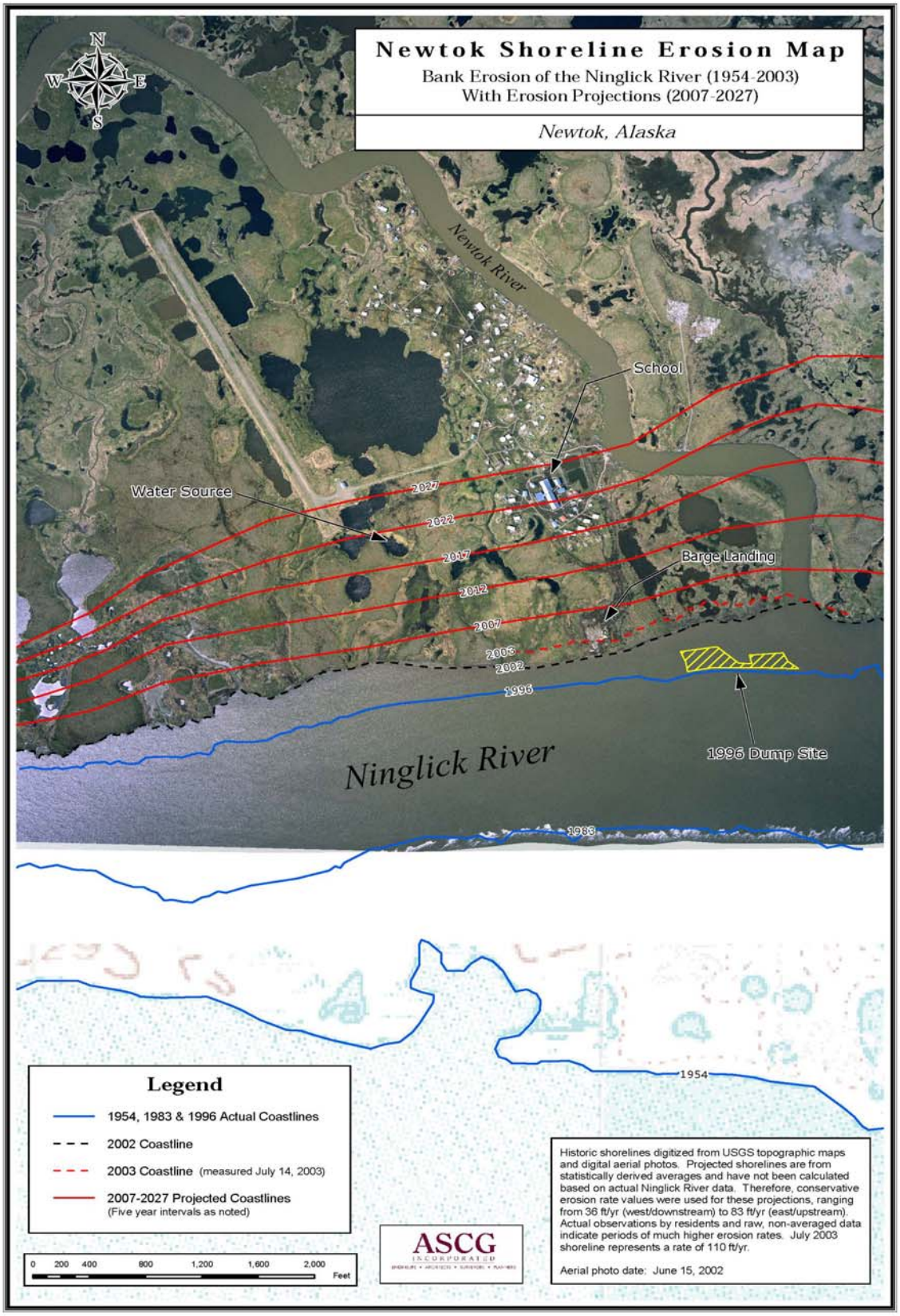
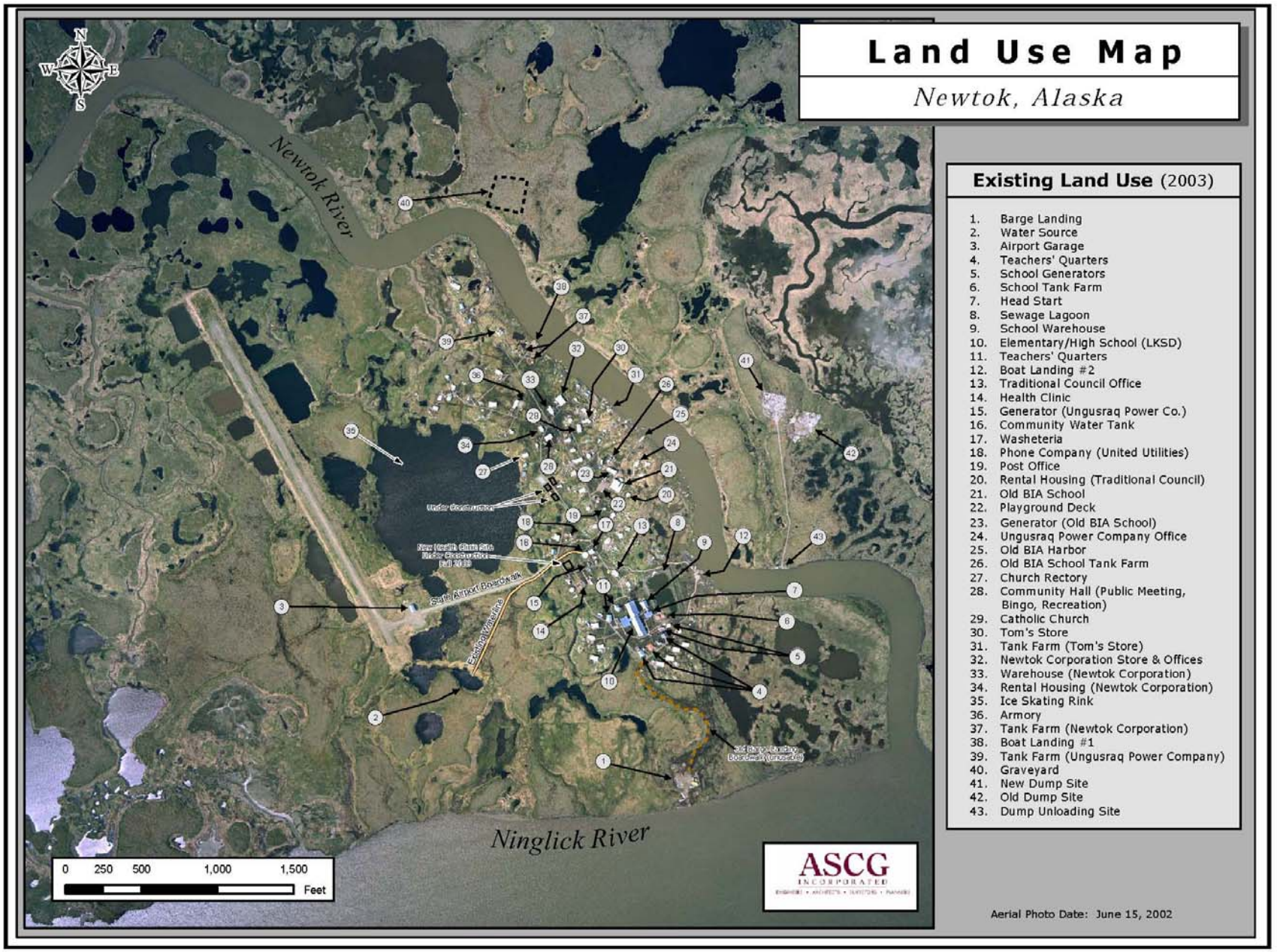

Newtok
Proposed Newtok Relocation Site
Proposed Nelson Island Road Alignment
Tununak
Tooksook Bay
Nightmute
NINGLICK RIVER
BAIRD INLET
HAZEN BAY
Nelson Island
NELSON ISLAND
Kagalurpak Lake
YUKON DELTA NA
Emperor Island
Kasinuk Mountain
Erchakrtuk Mountain
Kaluyut Mountains
Nunakak Camp
Kigigak Island
Nightmute
Umkumiut
Cape Vancouver
Base Map Created with TOPO! by National Geographic
N
0 2.5 5 10 15 20 Miles
Map Created by Central Region Materials
July 2006
Newtok Airport Relocation
Nelson Island Overview
Figure 1


Ninglick River
Ninglick River
Alaska Mainland
Newtok
Ninglick River
Baird Inlet
Nelson Island
Newtok Flood - September 22, 2005
These maps show the extent of a flood which occured at Newtok on September 22, 2005. The floodwaters completely encircled the village, effectively making it an island for several days. Several houses were only connected to the village via temporarily floating boardwalks.
The data seen here were gathered during a visit to Newtok on March 9, 2006. Residents indicated on aerial photos the extent of flooding around and within their village.
G:\EN-CW\EN-CW-ER\Wilson\Newtok\Newtok_Flood.mxd
Meters
0 125 250 500 750 1,000


Newtok Shoreline Erosion Map
Bank Erosion of the Ninglick River (1954-2003)
With Erosion Projections (2007-2027)
Newtok, Alaska
N
W
E
S
Newtok River
School
Water Source
Barge Landing
2027
2022
2017
2012
2007
2003
2002
1996
1983
1954
Ninglick River
1996 Dump Site
Legend
1954, 1983 & 1996 Actual Coastlines
2002 Coastline
2003 Coastline (measured July 14, 2003)
2007-2027 Projected Coastlines
(Five year intervals as noted)
0 200 400 800 1,200 1,600 2,000
Feet
ASCG
INCORPORATED
Historic shorelines digitized from USGS topographic maps and digital aerial photos. Projected shorelines are from statistically derived averages and have not been calculated based on actual Ninglick River data. Therefore, conservative erosion rate values were used for these projections, ranging from 36 ft/yr (west/downstream) to 83 ft/yr (east/upstream). Actual observations by residents and raw, non-averaged data indicate periods of much higher erosion rates. July 2003 shoreline represents a rate of 110 ft/yr.
Aerial photo date: June 15, 2002


Land Use Map
Newtok, Alaska
Existing Land Use (2003)
1. Barge Landing
2. Water Source
3. Airport Garage
4. Teachers' Quarters
5. School Generators
6. School Tank Farm
7. Head Start
8. Sewage Lagoon
9. School Warehouse
10. Elementary/High School (LKSD)
11. Teachers' Quarters
12. Boat Landing #2
13. Traditional Council Office
14. Health Clinic
15. Generator (Ungusraq Power Co.)
16. Community Water Tank
17. Washeteria
18. Phone Company (United Utilities)
19. Post Office
20. Rental Housing (Traditional Council)
21. Old BIA School
22. Playground Deck
23. Generator (Old BIA School)
24. Ungusraq Power Company Office
25. Old BIA Harbor
26. Old BIA School Tank Farm
27. Church Rectory
28. Community Hall (Public Meeting, Bingo, Recreation)
29. Catholic Church
30. Tom's Store
31. Tank Farm (Tom's Store)
32. Newtok Corporation Store & Offices
33. Warehouse (Newtok Corporation)
34. Rental Housing (Newtok Corporation)
35. Ice Skating Rink
36. Armory
37. Tank Farm (Newtok Corporation)
38. Boat Landing #1
39. Tank Farm (Ungusraq Power Company)
40. Graveyard
41. New Dump Site
42. Old Dump Site
43. Dump Unloading Site
Newtok River
Ninglick River
Under Construction
New Health Clinic Site Under Construction Fall 2008
Gravel Airport Boardwalk
Existing Waterline
0 250 500 1,000 1,500
Feet
ASCG INCORPORATED
Aerial Photo Date: June 15, 2002

		Developed by the Newtok Planning Group					
	Note: The Village has been named Mertarvik instead of Takikchak						
TABLE 1: *NEWTOK PRELIMINARY* RELOCATION PLANNING ACTIVITIES							
No.	Activity Title	Activity Description	Potential Lead Agency	Other Agencies Involved	Duration	Inter-Dependancies	Prelim. Cost
1	Legislative Funding Initiatives to Support the Relocation of Newtok to Takikchak	Recognizing the rather unique situation that Newtok is in, the normal funding mechanisms and funding streams and amounts of funding available to Newtok do not appear to be adequate to accomplish a relocation of the village in a timely and reasonable manner. Therefore, key funding initiatives would be developed and presented to appropriate state (and perhaps Federal) legislators to help ensure that the relocation of Newtok can be realized. A Task Force consisting of representatives of NTC and appropriate agencies would be formed to carry out this activity.	DCED	NTC; Denali Commission; AVCP; HSEM.	Six Months	This could involve joint funding and a collaborative effort among participating agencies.	$50,000
2	NEPA Studies and Documentation for the Relocation of Newtok	This involves conducting the required environmental, physical, and social studies required to support a proper NEPA assessment, evaluation and documentation of the relocation of the Newtok Community to the Takikchak site. Because of the potential need for multiple project-specific NEPA documentation accompanying the complexity of relocation activities (e.g., airport development, Harbor and Barge Landing development) it would be appropriate to prepare a "Programmatic" NEPA document (likely an EIS). Since the NEPA document is likely to be programmatic, a wider geographic scope may be necessary to ensure that all potential locations for facilities required by the community are evaluated. The supporting technical studies would include a coordinated environmental investigation of the Takikchak site and environs, including fish and wildlife habitats; migratory bird activity; endangered species; and wetland identification.	COE	NTC; AKDOT-PF; FAA; DCED; Denali Commission.	Two Years	The required technical support investigations and studies would commence fairly early in the relocation planning process, and be completed before preparation of the Community Layout Plan (Activity #6), and once the general location of the new community is known. COE initiated a programmatic EIS in August 2005. Please see Activity #19 for additional information.	$600,000
3	Takikchak Airport Reconnaissance Study	This study involves identifying, assessing, and evaluating at a conceptual level reasonable alternative locations for a new airfield in the vicinity of the Takikchak site to serve the relocated Newtok Community.	AKDOT-PF	NTC; FAA; COE.	One Year	This activity links to Detailed Airport Study and Design (Activity #23). This activity was initiated by AKDOT-PF in May 2005.	$100,000
4	Aerial Photography Survey of the Takikchak Study Area	This involves an aerial photography survey of the Takikchak site and environs, using sufficient ground control to be able to provide 1" to 100' scale for planning purposes. The controls would also be established in enough detail to allow 5-foot contour topographic mapping to be developed. The survey would be coordinate with other agencies needing survey and mapping for planning and design puposes (e.g., AKDOT-PF).	COE	DCED; AKDOT-PF;	Six Months	This activity would be performed prior to developing the Community Layout Plan (Activity #6), in order to provide valuable baseline information to a variety of agencies involved in the Newtok relocation planning effort. The ground controls established for this activity would be set up to facilitate the detailed topographic mapping required for subsequent design work (e.g., Activity #8). Aerial photography of the new site (Activity #4) was performed in June 2005.	$25,000
5	Comprehensive Archaeological Survey of the Takikchak Site Area	This involves conducting an archaelogical survey of the Takikchak site and environs and prepare a suitable report documenting the methodology and findings. This study will provide valuable guidance in the conceptual and detailed planning for the community and for all infrastructure and facilities (e.g., airfield, landfill) needed to serve the relocated Newtok Community.	COE	NTC;	Six Months	This investigation preceeds the preparation of the Community Layout PLan (Activity #6) and specific feasibility studies and design so that known archaeological sites and traditional uses can be preserved or otherwise accounted for and proper mitigation steps taken. The COE performed a preliminary survey in 2002, and re-initiated and expanded this activity in Summer 2005. The COE will complete this activity in Summer 2006.	$75,000

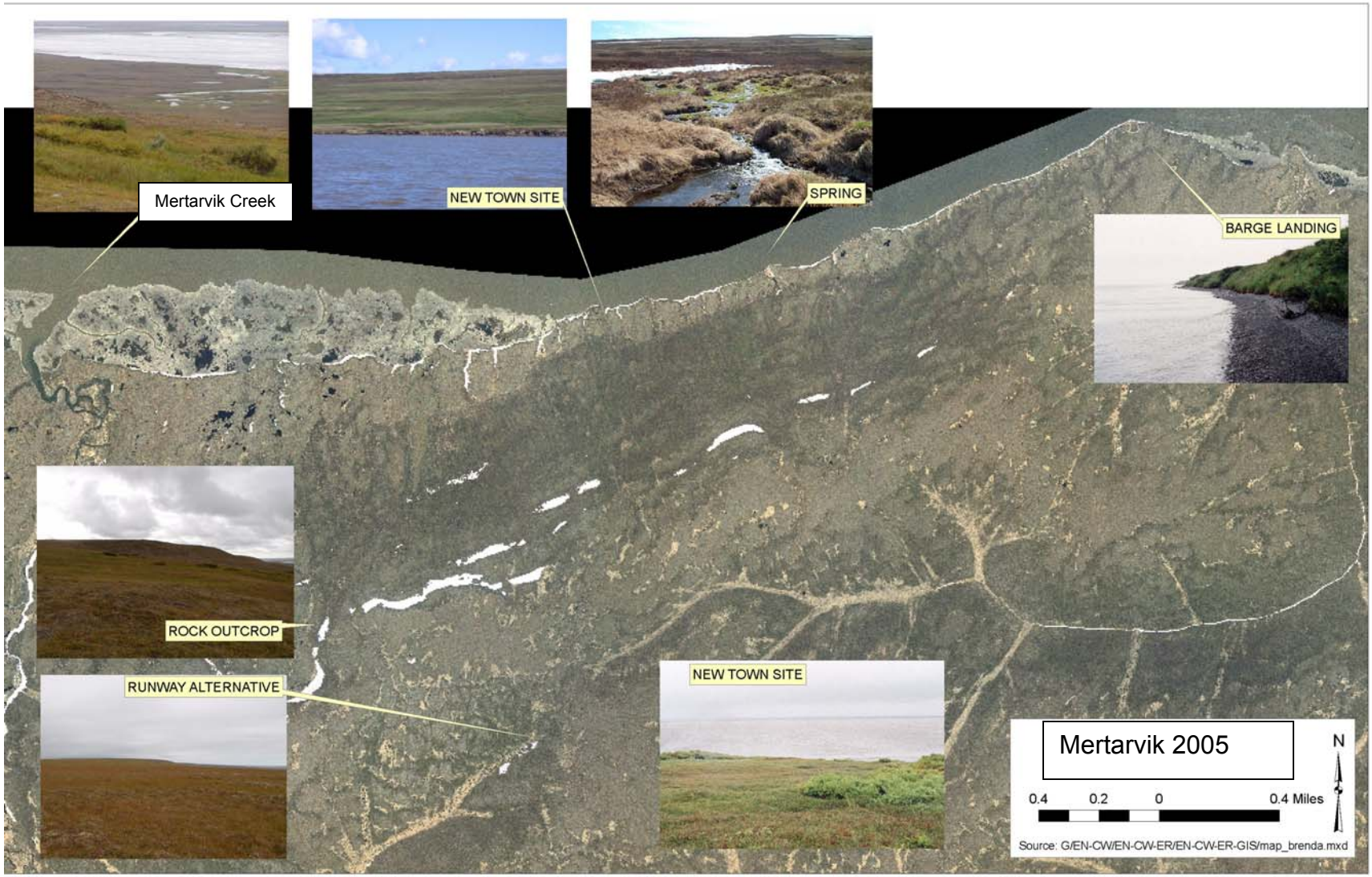
6	Community Layout Plan	Drawing upon past community planning efforts for other villages, and coordinating with the planning already done for Newtok, a "Community Layout Plan" for the Takikchak site would be prepared. The Plan would identify specific sites for all necessary community elements. The Newtok Community would be involved in the process. This Plan would also describe how the former Newtok village site would serve the residents of the "New Newtok".	NTC; COE	DCED;AK DOT-PF; Rural CAP.	One Year	This activity would be coordinated with the Takikchak Airport Reconnaissance Study (Activity #3). Also, this activity requires that Aerial Photography (Activity #4) is completed, the Archaeological Survey (Activity #5), and the Topographic Mapping (Activity #8) and NEPA Environmental Surveys (Activity #2) are underway.	$200,000
7	Relocation Funding Plan for Newtok	This involves the following: (a) identifying, assessing, and documenting existing grants and funding programs available to Native Alaskan Communities that could assist Newtok in the relocation effort; (b) providing assistance to Newtok in obtaining these grants and other funds; (c) developing an overall Funding Plan that utilizes existing funding sources and funding streams, creates special funding programs targeted at assisting the unique situation of Newtok; and includes private funding sources such as foundations. The Community is currently receiving about $55,000/year from AVCP-RHA. Administration for Native Americans could provide $175,000/year for 3 years. Newtok is likely eligible for a $30,000 Community Block Grant. VSW currently has $175,000 to do a solid waste relocation study. Newtok may qualify for federal disaster relief funds. Agencies should consider building a "Trust Fund" for Newtok to be used for relocation. A documentary of Newtok's situation could be developed to help raise private funds.	DCED	NTC; Denali Commission; AVCP; COE; HSEM.	Two Years	This Activity could be combined with preparation of the Legislative Funding Initiatives (Activity #1), under one Task Force.	$75,000
8	Topographic Mapping of the Takikchak Site	This involves developing detailed topographic mapping of the Takikchak Site from aerial photography. For planning and preliminary design purposes, 5-foot contours would be developed, and for detailed design, 2-foot contours would be developed for more specific areas where infrastructure elements are to be located.	COE	DCED; AKDOT-PF.	One Year	The development of 5-foot contour mapping would be done in conjunction with preparation of the Community Layout Plan (Activity #6). The development of the more detailed 2-foot contour mapping would be required in time to support engineering design of community infrastructure and utilities (e.g., water, wastewater, landfill, roads, school). This activity would follow Aerial Photography (Activity #4).	$20,000
9	Comprehensive Housing Needs Study	This involves a comprehensive study of the existing and future housing needs and housing resources in Newtok . The study would include an assessment and evaluation of existing housing and the requirements and funding for relocating the houses that can be safely moved to the new site. The study would likewise assess and evaluate projected housing needs at the new site, and develop an implementation plan for providing for all the housing needs at the new site. The study would also develop a plan for obtaining and implementing the funding required for moving existing housing, and constructing new housing.	NTC	NTC; HUD; AVCP-H; BIA; NAHC; Rural Cap	One Year	This activity would provide valuable information for the Community Layout Plan (Activity #6), the Plan of Subdivision (Activity #13), and the Water, Wastewater, Solid Waste Planning (Activity #19).	$75,000
10	Wind Data for Airport Siting Analysis	This involves establishing a meterological station in the vicinity of the Takikchak site to measure and monitor climatological data including wind speed and direction. This will provide a baseline of such information that will be used to plan the location and orientation of the airfield to be developed to serve the relocated Newtok Community.	AKDOT-PF	NTC; FAA; AIDEA/AEA.	Two Years	This activity would follow Takikchak Airport Reconnaissance Study (Activity #3), and is linked to the Detailed Airport Planning and Design (Activity #23).	$75,000
11	Multiple-year "Physical Relocation Plan/Interim Operating Plan" for Moving to the Takikchak Site.	This involves developing a "Physical Relocation Plan" for the actual physical relocation of the Newtok community to the Takikchak Site, and an "Interim Operating Plan" until the relocation is completed. This activity would initially identify what constiutes the minimum facilites, infrastructure, buildings, and level of services that would need to be established, and how they would be operated at the Takikchak site - and the existing Newtok site - in order for the physical relocation to take place over a reasonable time period. This Plan would also identify a feasible sequence of development and construction activities that would be required to accomplish the complete relocation of the entire Newtok community over a reasonable time frame, while providing adequate and safe services and infrastructure at both the former and new sites. A five-year physical relocation period is suggested as a starting point for discussion. This Plan would also include a determination of which structures, buildings, and other facilities could be moved from the existing community site to the new site, and which would require replacement.	COE	NTC; DCED; AK DOT-PF; Rural CAP; VSW; Denali Commission; AIDEA/AEA; AVCP-H; LKSD; YKHC; HSEM.	One Year	This would involve the NTC requesting the appropriate agencies to have the plan prepared. This activity would link with the Community Layout Plan (Activity #6), the Plan of Subdivision (Activity #13), and the Planning and Design of the Water, Wastewater, and Solid Waste Systems (Activity #19).	$150,000

12	Materials Borrow Site Planning and Feasibility Report	This involves completing a planning and feasibility study and report for alternative materials borrow sites that would be available for construction needs at the Takikchak site. The study would include an evaluation and costing of haul roads that may be required to deliver the borrow materials.	AKDOT-PF	NTC; COE;	One Year	This follows the preparation of the Community Layout Plan (Activity #6), and the Detailed Geotechnical Investigation (Activity #18).	$100,000
13	Plan of Subdivision for the Community at the New Site.	Once the Community-Based Development Plan has been created for the new community area at Takikchak, a Plan of Subdivision would be prepared, showing how the houses and other buildings and facilites would be laid out with in the community. This would be integrated with the Real Estate Plan (Activity #22) so that each individual lot would be identified as to ownership, and all rights-of-way and utility easements would be identified as well, and become part of individual deeds.	NTC	DCED; AVCP-H; COE	One Year	This follows the Topographic Mapping (Activity #8), Community Layout Plan (Activity #6), and Detailed Geotechnical Investigation (Activity #18), and would be coordinated with the Comprehensive Housing Needs Study (Activity #9).	$75,000
14	Barge Landing Planning, Feasibility, and Design Report	This involves the planning, feasibility analysis, and design of a Barge Landing area to serve the Takikchak site. Initial investigations would include bathymetric measurements.	COE, or AK DOT-PF	NTC	One Year	This activity requires that the Community Layout Plan (Activity #6) be underway, or at least that the location for the Barge Landing is confirmed The initial bathymetric investigations and other data-gathering can commence prior to the Development Plan, provided the anticipated general site area for the new village site is known. This activity would be coordinated with and could be combined with the Small Boat Harbor Planning and Design (Activity #15).	$300,000
15	Small Boat Harbor Planning, Feasibility, and Design Report	This involves the planning, feasibility analysis, and design of a Small Boat Harbor area to serve the Takikchak site. Initial investigations would include bathymetric measurements, coordinated with Activity #14.	COE	NTC;	One Year	This activity requires that the Community Layout Plan (Activity #6) be underway, or at least that the location for the Small Boat Harbor has been confirmed. The initial bathymetric investigations and other data-gathering can commence prior to the Development Plan, provided the anticipated general site area for the new village site is known. This activity would be coordinated with and could be combined with Barge Landing Planning and Design (Activity #14).	$300,000
16	Site Parameters for all Utilities and Infrastructure.	This involves developing detailed site requirements and design criteria (Site Parameters) for all utilities and infrastructure identified in the Community Layout Plan (Activity #6). These Site Parameters would be made availble to the appropriate agencies to facilitate their planning and feasibility studies, and perliminary and detailed design for these facilities.	NTC	NTC; DCED; COE; AK DOT-PF; Rural CAP; VSW; Denali Commission AIDEA/AEA; AVCP-H; LKSD; YKHC.	One Year	This follows theTopographic Mapping (Activity #8), the Community Layout Plan (Activity #6), and the Detailed Geotechnical Investigation (Activity #18).	$150,000
17	Planning, Feasibility Study, and Design of School Facilities for the Takikchak Site	This involves undertaking a School Planning and Feasibility Study to determine if is more feasible to relocate any or all of the existing school facilities from the existing site to the new site, or to develop completely new facilities. A decision would then be made as to the preferred course of action to be taken. Following this, a Design Report would be prepared for the preferred action. The Report would include a plan for funding the relocated/new school facilities, both during the design phase and the construction phase. Construction of the chosen design for the school facilities at the new site would be scheduled to take place during implementation of the Multiple Year Relocation/Interim Operating Plan (Activity #11).	LKSD	NTC	Two Years	This follows the Community Layout Plan (Activity #6).	$300,000

18	Detailed Geotechnical Investigation of the Takikchak Site	This involves completing a thorough geotechnical investigation of the Takikchak Site. This will provide valuable design data required for design of infrastructure and buildings at the new site.	COE	NTC	One Year	This investigation would occur at the beginning of the preparation of the Community Layout Plan (Activity #6), and would preceed any feasibility studies and design involving infrastructure and buildings so that accurate costs can be developed regarding foundations and stability issues.	$250,000
19	Water, Wastewater, and Solid Waste Planning, Feasibility, and Design Report	This involves carrying out the required investigations, as well as the planning and feasibility studies necessary to design appropriate water supply and distribution, wastewater collection and disposal, and solid waste collection and disposal systems and facilities to adequately serve the relocated Newtok Community at the Takikchak site. In 2004, COE funded USGS to conduct water quality and flow monitoring in creek at new site that may be potential water source for relocated Newtok. As and if additional sources of water are identified, additional water quality and flow testing may be included during this planning and feasibility phase.	NTC	VSW; LKSD	Two Years	These studies can initially overlap with other planning efforts for the Takikchak site. This activity would use information from the water quality and flow studies being conducted by the USGS. Also, the Community Layout Plan (Activity #6) and the Plan of Subdivision (Activity #13) would be completed prior to this activity.	$350,000
20	Fuel Storage Tank Planning, Feasibility, and Design Report	This involves conducting a planning and feasibility study of the Fuel Storage Tank requirements to serve the relocated Newtok Community at Takikchak. The Study would include an assessment and evaluation of the potential for relocating any of the existing tanks from the existing village site and constructing new tanks at the new site. Based on the results of the conceptual planning and feasibilty study, detailed design of the new tanks would then be completed. The design would include a construction schedule that is integrated with the Multiple Year Relocation/Interim Operating Plan (Activity #11) so that adequate fuel storage is provided to the new community as the relocation to Takikchak proceeds.	AIDEA/AEA	NTC; Denali Commission	One Year	Follows the Community Layout Plan (Activity #6).	$150,000
21	Electrical Power Facility Planning, Feasibility, and Design Report	This involves conducting a planning and feasibility study of the Electric Power generation and distribution facility and system requirements to serve the relocated Newtok Community at Takikchak. The Study would include an assessment and evaluation of the potential for relocating any of the existing facilities from the existing village site and constructing new facilites at the new site. Based on the results of the conceptual planning and feasibilty study, detailed design of the new facilities would be completed. The design would include a construction schedule that is integrated with the Multiple Year Relocation/Interim Operating Plan (Activity #11) so that adequate electrical power is provided to the new community as the relocation to Takikchak proceeds.	AIDEA/AEA	NTC; Denali Commission	One Year	Follows Community Layout Plan (Activity #6).	$150,000
22	Real Estate Plan for the Takikchak Site	This involves undertaking a Real Estate Survey of the new community site (and other new land holdings) and preparing a comprehensive Real Estate Plan for the New Site. The Plan would include an identification and assesssment of the steps necessary to legally enter, survey, subdivide, and place easements, rights-of-way, and caveats on all subdivided parcels, and perform all other real estate transactions necessary for the proper and legal settlement of the Newtok Community at the Takikchak Site. The Plan would also include a "Real Estate Implementation Plan and Schedule" for completing all the necessary actions within a time frame that coincides with other relocation planning. Implementation of all identified activities would then be completed according to the prescribed schedule. A critical step may be the transfer of the Takikchak land to a non-profit entity.	AVCP-H	DCED; NTC	One Year	This follows the Plan of Subdivision (Activity #13). This activity would be coordinated with sereral other activities, e.g., Comprehensive Housing Needs Study (Activity #9), the Multi-year Physical Relocation/Operation Plan (Activity #11), Materials Borrow Site Study (Activity #12), Barge Landing Planning and Design (Activity #14), Small Boat Harbor Planning and Design (Activity #15),Site Parameters for Utilities and Infrastructure (Activity #16), School Facilities Planning and Design (Activity #17), Fuel Storage Planning and Design (Activity #20), Electrical Power Facilities Planning and Design (Activity #21), and Water, Wastewater, Solid Waste Planning and Design (Activity #19).	$250,000

18	Detailed Geotechnical Investigation of the Takikchak Site	This involves completing a thorough geotechnical investigation of the Takikchak Site. This will provide valuable design data required for design of infrastructure and buildings at the new site.	COE	NTC	One Year	This investigation would occur at the beginning of the preparation of the Community Layout Plan (Activity #6), and would preceed any feasibility studies and design involving infrastructure and buildings so that accurate costs can be developed regarding foundations and stability issues.	$250,000
19	Water, Wastewater, and Solid Waste Planning, Feasibility, and Design Report	This involves carrying out the required investigations, as well as the planning and feasibility studies necessary to design appropriate water supply and distribution, wastewater collection and disposal, and solid waste collection and disposal systems and facilities to adequately serve the relocated Newtok Community at the Takikchak site. In 2004, COE funded USGS to conduct water quality and flow monitoring in creek at new site that may be potential water source for relocated Newtok. As and if additional sources of water are identified, additional water quality and flow testing may be included during this planning and feasibility phase.	NTC	VSW; LKSD	Two Years	These studies can initially overlap with other planning efforts for the Takikchak site. This activity would use information from the water quality and flow studies being conducted by the USGS. Also, the Community Layout Plan (Activity #6) and the Plan of Subdivision (Activity #13) would be completed prior to this activity.	$350,000
20	Fuel Storage Tank Planning, Feasibility, and Design Report	This involves conducting a planning and feasibility study of the Fuel Storage Tank requirements to serve the relocated Newtok Community at Takikchak. The Study would include an assessment and evaluation of the potential for relocating any of the existing tanks from the existing village site and constructing new tanks at the new site. Based on the results of the conceptual planning and feasibilty study, detailed design of the new tanks would then be completed. The design would include a construction schedule that is integrated with the Multiple Year Relocation/Interim Operating Plan (Activity #11) so that adequate fuel storage is provided to the new community as the relocation to Takikchak proceeds.	AIDEA/AEA	NTC; Denali Commission	One Year	Follows the Community Layout Plan (Activity #6).	$150,000
21	Electrical Power Facility Planning, Feasibility, and Design Report	This involves conducting a planning and feasibility study of the Electric Power generation and distribution facility and system requirements to serve the relocated Newtok Community at Takikchak. The Study would include an assessment and evaluation of the potential for relocating any of the existing facilities from the existing village site and constructing new facilites at the new site. Based on the results of the conceptual planning and feasibilty study, detailed design of the new facilities would be completed. The design would include a construction schedule that is integrated with the Multiple Year Relocation/Interim Operating Plan (Activity #11) so that adequate electrical power is provided to the new community as the relocation to Takikchak proceeds.	AIDEA/AEA	NTC; Denali Commission	One Year	Follows Community Layout Plan (Activity #6).	$150,000
22	Real Estate Plan for the Takikchak Site	This involves undertaking a Real Estate Survey of the new community site (and other new land holdings) and preparing a comprehensive Real Estate Plan for the New Site. The Plan would include an identification and assesssment of the steps necessary to legally enter, survey, subdivide, and place easements, rights-of-way, and caveats on all subdivided parcels, and perform all other real estate transactions necessary for the proper and legal settlement of the Newtok Community at the Takikchak Site. The Plan would also include a "Real Estate Implementation Plan and Schedule" for completing all the necessary actions within a time frame that coincides with other relocation planning. Implementation of all identified activities would then be completed according to the prescribed schedule. A critical step may be the transfer of the Takikchak land to a non-profit entity.	AVCP-H	DCED; NTC	One Year	This follows the Plan of Subdivision (Activity #13). This activity would be coordinated with sereral other activities, e.g., Comprehensive Housing Needs Study (Activity #9), the Multi-year Physical Relocation/Operation Plan (Activity #11), Materials Borrow Site Study (Activity #12), Barge Landing Planning and Design (Activity #14), Small Boat Harbor Planning and Design (Activity #15),Site Parameters for Utilities and Infrastructure (Activity #16), School Facilities Planning and Design (Activity #17), Fuel Storage Planning and Design (Activity #20), Electrical Power Facilities Planning and Design (Activity #21), and Water, Wastewater, Solid Waste Planning and Design (Activity #19).	$250,000

23	Detailed Airport Planning, Feasibility, and Design Report	This involves preparing a detailed airport planning, feasibility, and design report for a new airport facility to serve the relocated Newtok Community. The Study and report would result from decisions made by AKDOT-PF, NTC, FAA and others (based on previous studies) as to which alternative is most feasible for the Takikchak Site. This planning, feasibility, and design study would utilize information from all previous relevant studies, including Takikchak Airport Reconnaissance Study (Activity #3), Detailed Geotechnical Investigation (Activity #18), and Community Layout Plan (Activity #6). The FAA has stated that the approach to airport planning and implementation for Newtok should insure that there are not two functioning airports serving Newtok during and following relocation.	AKDOT-PF	NTC; FAA; COE	One Year	This study requires input from the Community Layout Plan (Activity #6) regarding the locations of the landfill and housing, to ensure minimum distances. This activity requires Collection of Wind Data (Activity #10) be completed, and follows the Takikchak Airport Reconnaissance Study (Activity #3). FAA funding for this study is dependent on having a community being established at Takikchak. Minimum development required by the FAA is housing, school, and Post Office.	$300,000


Mertarvik Creek
NEW TOWN SITE
SPRING
BARGE LANDING
ROCK OUTCROP
RUNWAY ALTERNATIVE
NEW TOWN SITE
Mertarvik 2005
N
0.4 0.2 0 0.4 Miles
Source: G/EN-CW/EN-CW-ER/EN-CW-ER-GIS/map_brenda.mxd

Newtok, Alaska September 22 – 23, 2005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